# Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

APRIL ★ 1950

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

*Page 109—Journal Section of the American Society of Heating and Ventilating Engineers*

*How women's apparel chain stores are air conditioned—page 75*

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**Operating "Kink" for Process Piping . . . . . 79**

**Radiant Heating for a Church . . . . . 99**

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# A "HOT" PROSPECT for a "cool" sale

Here's your best prospect for a quick, profitable Thermolier Unit Heater contract. He's the owner or manager of a plant, shop, store, garage or service station who went through last winter with an old-fashioned heating system. In his hand are all the fuel bills for heating the air up at ceiling level instead of down at the working level. In his mind right now is a determination not to throw away money in that fashion next winter.

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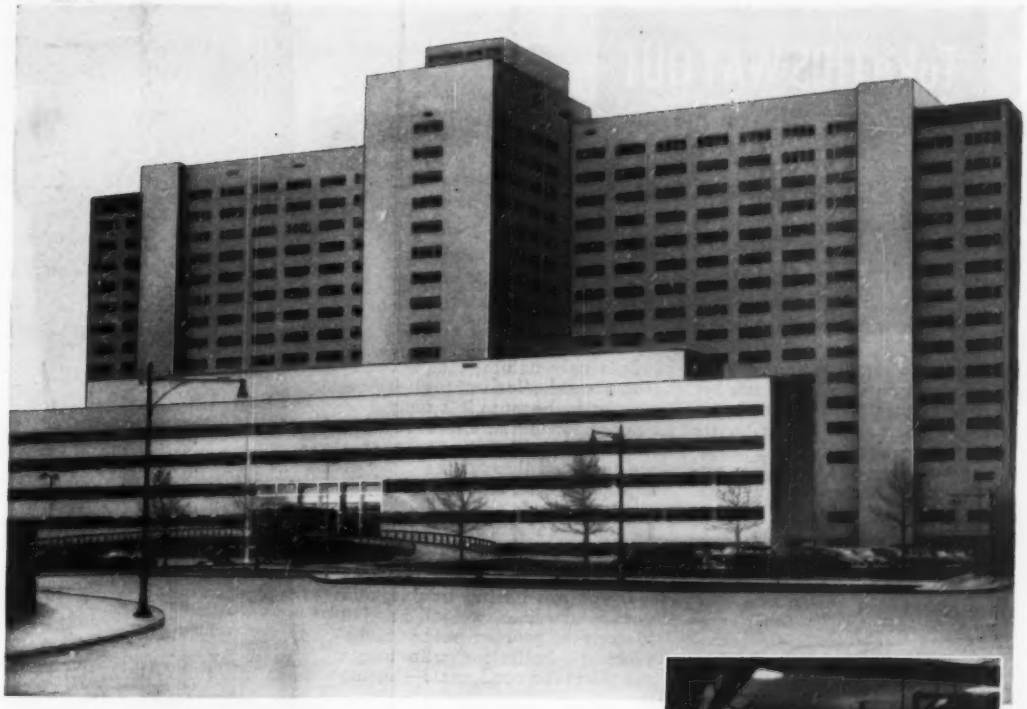

# America's toughest buyer OK's usAIRco equipment

The United States Army Engineers don't buy four carloads of anything unless they're convinced it's good. They're the toughest buyers going . . . and that's why, when they build a Vets' Hospital, it's the finest in the world.

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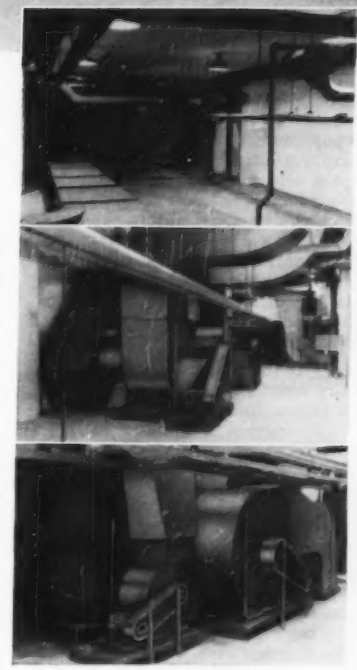

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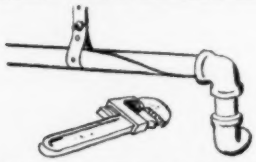
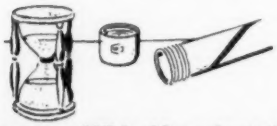
You can take different steps to modify the corrosive conditions—such as utilizing a deaerating heater—and to eliminate danger



points—by reaming the ends of all pipes, making-up joints properly, pitching lines so there are no low spots, and following good installation practice in other respects. But after you've done all this, the pipe must still carry a highly corrosive fluid, and the only final safeguard is to use a corrosion-resisting material. Engineers all over the country are finding the answer in Byers Wrought Iron pipe.

As an indication of how successfully wrought iron pipe stands up in return line service—one study



covering 125 buildings located in 25 cities in 17 states revealed wrought iron installations still serving after periods up to 70 years. The fact that such long service was not due to mild conditions was demonstrated by reports on the use of low first-cost materials. In every area, repairs and replacements had been necessary in a fraction of the comparative service life *to date* of wrought iron.

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(with which is merged the Aerologist)

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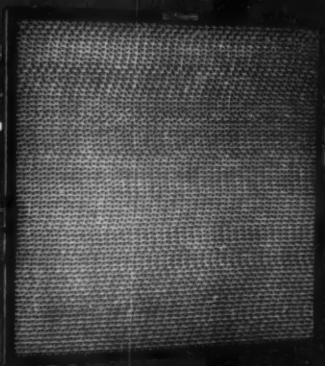

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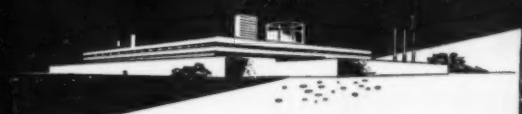

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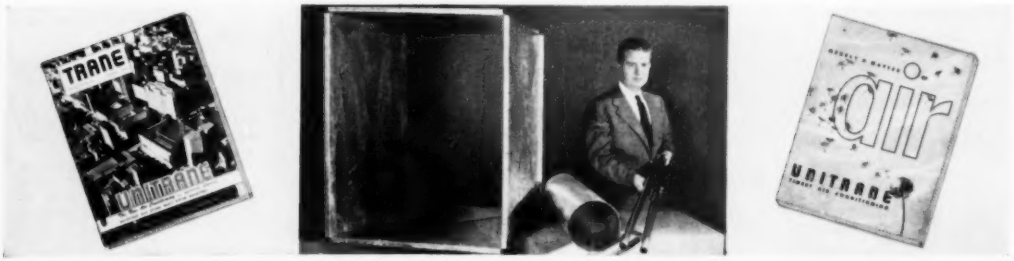
*Center:* Going, going, gone—from big ducts to small ducts to no ducts at all—UniTrane requires only simple water-type piping such as that being held in the illustration below. *Left:* Data bulletin DS-420 is for architects and engineers. *Right:* "Merely A Matter of Air" is an interesting non-technical discussion of multiroom air conditioning.



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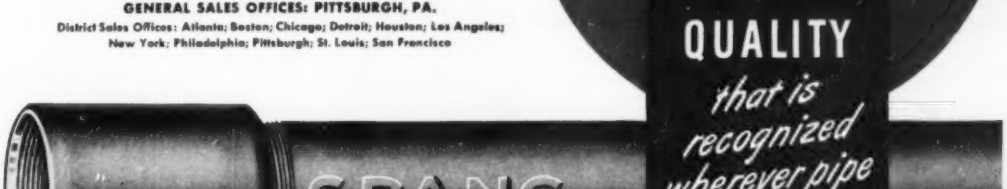

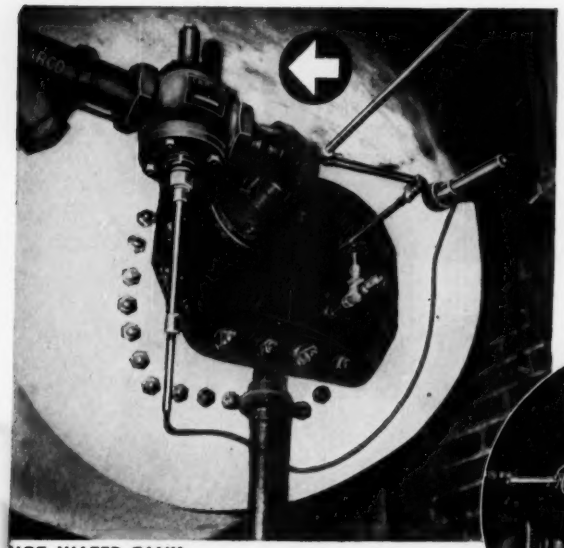

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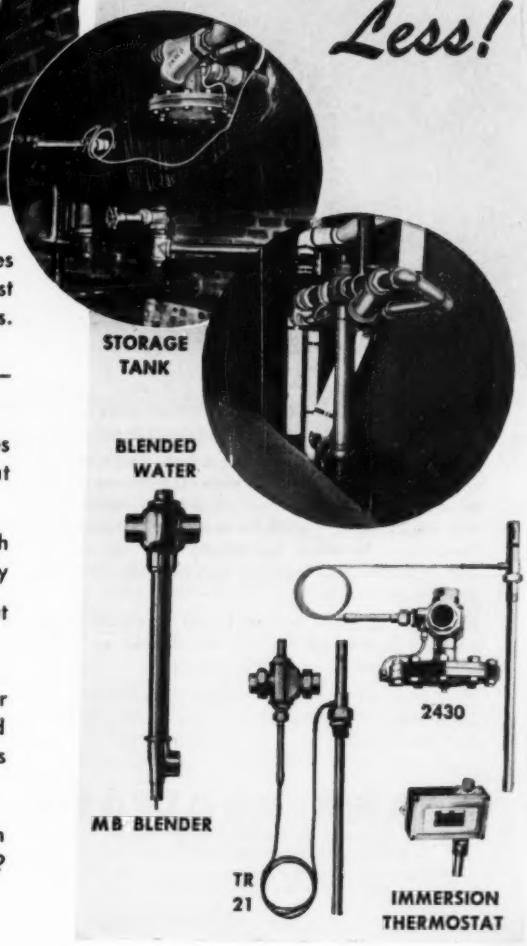


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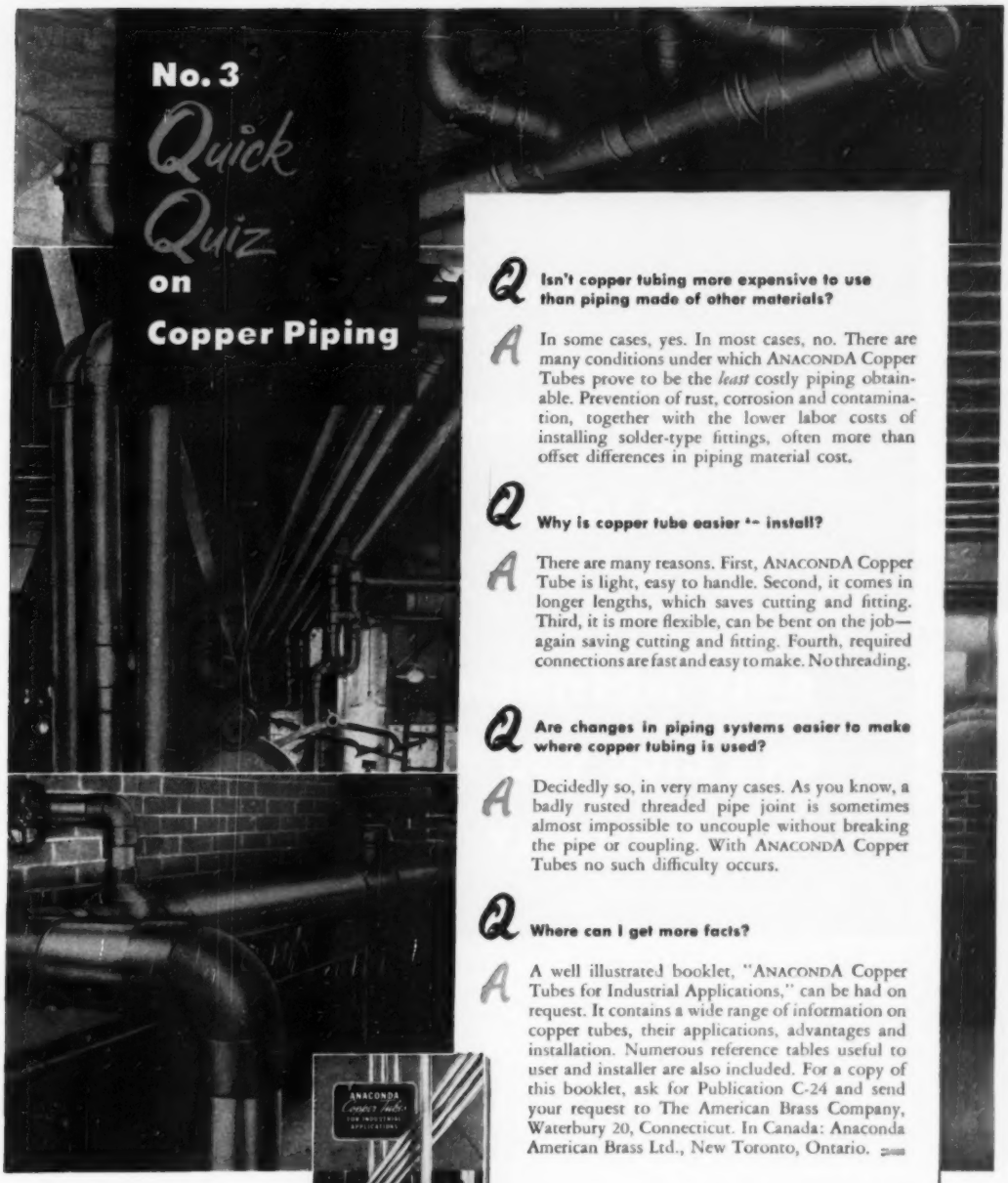


# No. 3 Quick Quiz on Copper Piping

**Q** **Isn't copper tubing more expensive to use than piping made of other materials?**

**A** In some cases, yes. In most cases, no. There are many conditions under which ANACONDA Copper Tubes prove to be the *least* costly piping obtainable. Prevention of rust, corrosion and contamination, together with the lower labor costs of installing solder-type fittings, often more than offset differences in piping material cost.

**Q** **Why is copper tube easier to install?**

**A** There are many reasons. First, ANACONDA Copper Tube is light, easy to handle. Second, it comes in longer lengths, which saves cutting and fitting. Third, it is more flexible, can be bent on the job—again saving cutting and fitting. Fourth, required connections are fast and easy to make. No threading.

**Q** **Are changes in piping systems easier to make where copper tubing is used?**

**A** Decidedly so, in very many cases. As you know, a badly rusted threaded pipe joint is sometimes almost impossible to uncouple without breaking the pipe or coupling. With ANACONDA Copper Tubes no such difficulty occurs.

**Q** **Where can I get more facts?**

**A** A well illustrated booklet, "ANACONDA Copper Tubes for Industrial Applications," can be had on request. It contains a wide range of information on copper tubes, their applications, advantages and installation. Numerous reference tables useful to user and installer are also included. For a copy of this booklet, ask for Publication C-24 and send your request to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

*For better Piping...use* **ANACONDA®**

**COPPER TUBES**

IN AIR CONDITIONING
*it's the*
COMPRESSOR THAT COUNTS

UNIT AIR CONDITIONERS

...OR COMPRESSORS

TO 100 hp.

ONLY WESTINGHOUSE
CAN GIVE YOU THIS RANGE
-HERMETICALLY-SEALED

Since 1933, Westinghouse has pioneered the hermetically-sealed compressor design in air conditioning. Today *only* Westinghouse can offer you this successful principle in *all* of its models, backed by 17 years of successful installations.

The Westinghouse Hermetically-Sealed Compressor is your guarantee of years of economical, trouble-free service. There are no belts to break or pulleys to adjust, no shaft seal refrigerant leaks. Reduced size and modern design lessen vibration and noise. Entirely enclosed in a steel shell, its refrigerant-cooled motor requires no ventilation and is protected from dirt, dust and moisture.

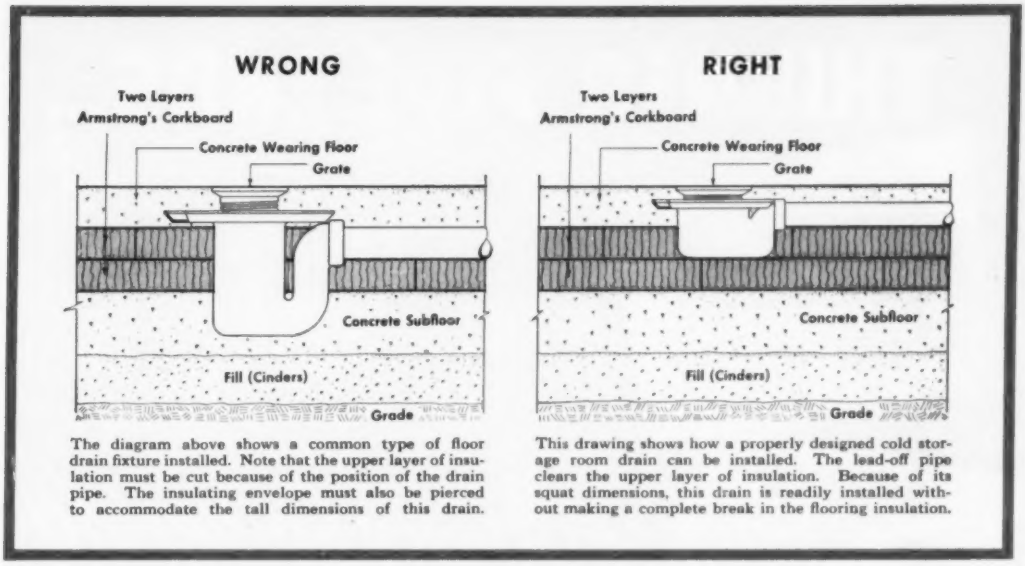
Whether you are considering a self-contained unit or a complete system, the compressor will make the difference. By choosing Westinghouse, you are assured of the benefits of hermetic sealing in *every* size. Sturtevant Division, Hyde Park, Boston 36, Mass.

YOU CAN BE SURE...IF IT'S

Westinghouse

J-80179

FIRST to introduce
HERMETICALLY-SEALED
COMPRESSORS IN
AIR CONDITIONING




The diagram above shows a common type of floor drain fixture installed. Note that the upper layer of insulation must be cut because of the position of the drain pipe. The insulating envelope must also be pierced to accommodate the tall dimensions of this drain.

This drawing shows how a properly designed cold storage room drain can be installed. The lead-off pipe clears the upper layer of insulation. Because of its squat dimensions, this drain is readily installed without making a complete break in the flooring insulation.

# How to install floor drains in refrigerated rooms

When you're planning a low-temperature room, remember that the use of a standard type floor drain results in higher installation costs and weakens the insulation envelope.

In standard drains the outlet leads away from the trap below the wearing floor, making it necessary to tunnel it through the insulation. Labor costs go up, and insulation thickness is reduced at this point. The place where the traps of these drains completely pierce the insulation is a weak spot where trouble may develop.

By choosing drains specially designed for cold rooms, these weaknesses can be corrected. The distance between outlet and base of these drains is shorter than in standard fixtures. Lead-off piping runs in the wearing floor. There's no need to tunnel through the floor insulation and reduce its efficiency. The shallow trap also allows for insulation thickness below its base.

Cold room drains and piping are installed before the last layer of floor insulation is laid. The last layer then is fitted under the drain pipe and around the trap, where it's sealed with hot asphalt. Then the concrete wearing floor is poured flush with the drain grating.

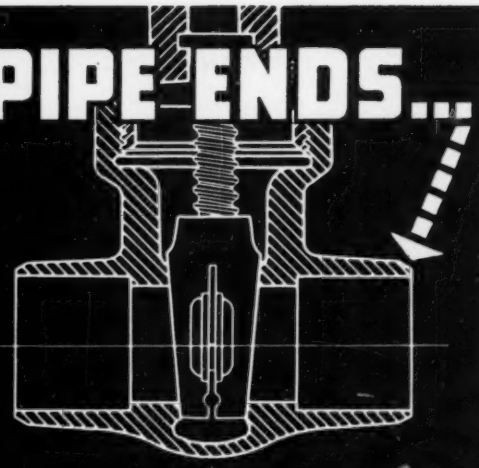
Correct design of a low-temperature room calls for a specialized knowledge of many details that aren't found in ordinary building plans. Armstrong engineers are familiar with these details. When you have a question involving the design of a low-temperature room, take advantage of their specialized knowledge. The complete contract service these men represent also offers you quality insulating materials and skilled mechanics to apply them. Call the Armstrong District Office located nearest you or write today to Armstrong Cork Company, 4404 Concord Street, Lancaster, Pennsylvania.

**ARMSTRONG'S INDUSTRIAL INSULATIONS**

MATERIALS (A) INSTALLATION

FOR ALL TEMPERATURES FROM 300° F. BELOW ZERO TO 2800° F.

# THINNER PIPE ENDS...



## for Easy Soldering

### NO. 6 GLOBE TYPE

100 lbs. W. S. P.
150 lbs. W. O. G.

Composition disc valve for all general service. Full swivel disc holder prevents excessive wear of either disc or seat.

### NO. 7 GLOBE TYPE

100 lbs. W. S. P.
150 lbs. W. O. G.

Same composition disc construction as No. 6 with addition of drain in center of body to prevent interference with pipe ends in draining.

### NO. 24 GATE TYPE

100 lbs. W. S. P.
150 lbs. W. O. G.

Ideal for all full flow service for low pressure. Features the Flexitite Disc* that assures a valve that starts tight and stays tight.

### No. 28 GATE TYPE

125 lbs. W. S. P.
200 lbs. W. O. G.

Hollow cored, slotted Flexitite Disc* assures all-around seal with the seat. This valve also available for same pressures in rising stem—the No. 29.

## CHECK THESE NEW O-B SOLDER TYPE VALVES

Quick, even distribution of heat through valve pipe ends is a must for leak-tight, copper-to-copper connections. By careful trimming of the valve wall, O-B has produced a fast-heating pipe end. Heat-wasting excess metal is eliminated without reducing the sturdiness of the valve itself.

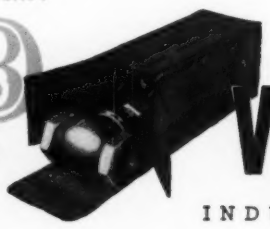
This thinner wall permits a rapid distribution ot heat through the pipe ends of the valve and assures an even flow of solder around the tubing. Carefully tapered, the pipe end walls take advantage of the inserted tubing for reinforcement resulting in a sturdy, leak-tight connection.

**AVAILABLE IN THE FOLLOWING SIZES**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| No. 6 | ⅜ | ½ | ¾ | 1 | All sizes indicated in inches. . . . . | | |
| No. 7 | ⅜ | ½ | ¾ | 1 | | | |
| No. 24 | ⅜ | ½ | ¾ | 1 | 1¼ | 1½ | 2 |
| No. 28 | ⅜ | ½ | ¾ | 1 | 1¼ | 1½ | 2 |
| No. 29 | ⅜ | ½ | ¾ | 1 | 1¼ | 1½ | 2 |

3003-V

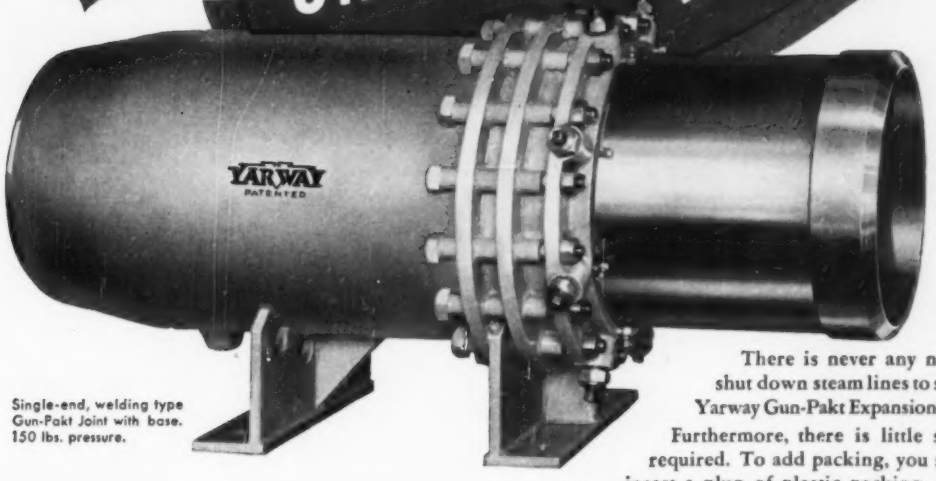
* Reg. U. S. Pat. Office



# Ohio Brass VALVES

FOR DOMESTIC AND INDUSTRIAL USE

# THIS EXPANSION JOINT IS SERVICED UNDER FULL STEAM PRESSURE




Single-end, welding type Gun-Pakt Joint with base. 150 lbs. pressure.

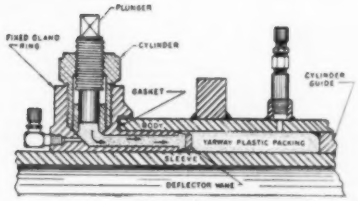
There is never any need to shut down steam lines to service Yarway Gun-Pakt Expansion Joints.

Furthermore, there is little service required. To add packing, you simply insert a plug of plastic packing, turn a wrench, and the job's done! Special Alemite fittings provide for proper lubrication.

Maintenance costs are trifling. One large user reports 65 cents per year per joint. Others claim less than that.

Gun-Pakt Joints are available with single or double-ends, welding or flanged types, in sizes from 2″ to 30″, with traverses from 4″ to 24″, and for pressures to 400 psi.

For the full Gun-Pakt story, write for Yarway Bulletin EJ-1912.




Close-up of cross-section showing detail of Gun-Pakt feature.

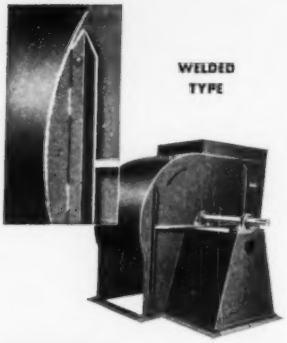
**YARNALL-WARING COMPANY**
**107 Mermaid Avenue, Philadelphia 18, Pa.**
***Branch Offices in Principal Cities***

**YARWAY** **GUN-PAKT EXPANSION JOINT**

Since 1889

# 61 Years of Progress and Development

nyb



WELDED TYPE

**Type ME Fans *Available in Either Welded or Bolted (knocked down) Construction***

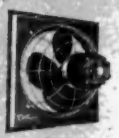
*nyb* Fans Class I and II feature ALL WELDED CONSTRUCTION as standard . . . for simplicity, extra strength and rigidity. They are dust tight, leak proof and desirable where building conditions permit. Welded construction may be had in all classes and sizes of *nyb* fans.

Where building openings will not permit the use of welded fans (shipped set up), bolted (knocked down) type is available.

BOLTED (KNOCK-DOWN) TYPE

All New York Blower Company products are laboratory tested, accurately rated and fully guaranteed in strict accordance with Standard Test Codes.

***Engineering Notes, Bulletin 493 gives full details.***



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## THE NEW YORK BLOWER COMPANY

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## *Loyalty to its high standards keeps H & H in the lead*

● To users of brass and copper coil strip, seamless tubing and tubular parts, nothing is more important than quality, everlasting uniformity, and a constant loyalty to specifications on which every order is based. That is why more and more firms are turning to the H & H Tube and Manufacturing Company for their tubing needs. If you, too, are interested in learning just how truly dependable a brass and copper tubing source can be, write, wire or call us today.

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**H & H TUBE AND MANUFACTURING COMPANY**

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There's a New Carrier Weathermaker for every air conditioning job . . . Summer—Winter . . . large—small!

1000 to 16,400 cfm in single units

Wide range of capacities for every air conditioning load and function. Complete flexibility in arrangement of functional sections and components. New improved fan combines stable characteristic, efficiency, quietness. Roomy compactness with new fans and inclined coil saves space and weight. Designed for on-the-job accessibility, simplifying routine service and maintenance. Coil connections on either end simplify piping layouts. Rugged welded casing, proved sound over the years. Effective insulation prevents sweating, rubber paint retards rust. Built in the Carrier tradition of leadership for long life, dependable service. For information write Carrier Corporation, Syracuse 1, N. Y.

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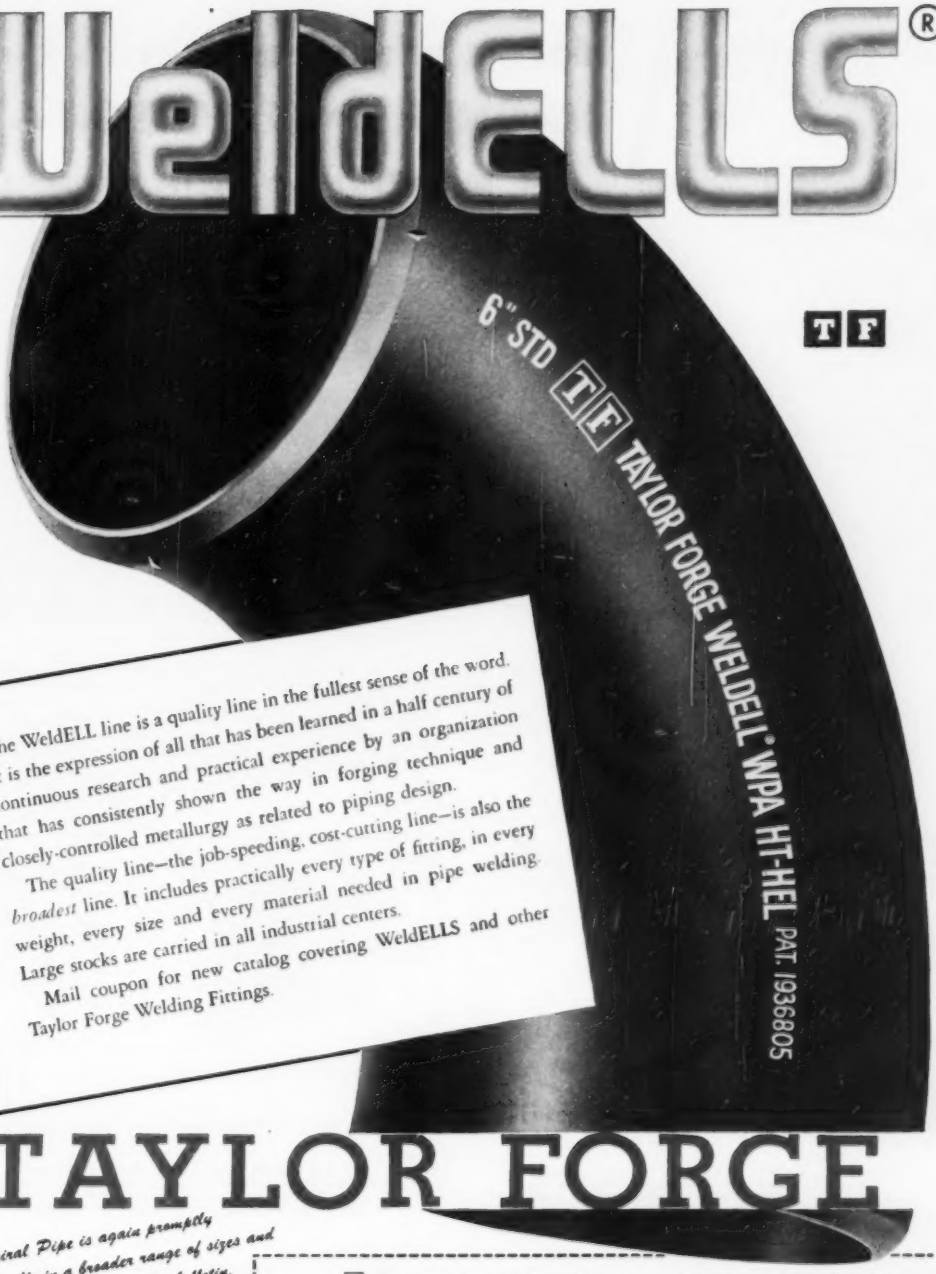
AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

# WeldELLS®




The WeldELL line is a quality line in the fullest sense of the word. It is the expression of all that has been learned in a half century of continuous research and practical experience by an organization that has consistently shown the way in forging technique and closely-controlled metallurgy as related to piping design.

The quality line—the job-speeding, cost-cutting line—is also the *broadest* line. It includes practically every type of fitting, in every weight, every size and every material needed in pipe welding. Large stocks are carried in all industrial centers.

Mail coupon for new catalog covering WeldELLS and other Taylor Forge Welding Fittings.

# TAYLOR FORGE

*Taylor Spiral Pipe is again promptly available in a broader range of sizes and thicknesses. Coupon brings pipe bulletin.*

TAYLOR FORGE & PIPE WORKS
P. O. Box 485, Chicago 90, Illinois
Offices in all principal cities: *Eastern Plant:* Carnegie, Pa. *Western Plant:* Fontana, Calif.

☐ Please send new Catalog 484 covering welding fittings and forged steel flanges.
☐ Send new Bulletin 493 covering Taylor Spiral Pipe and related fittings.

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510-0450 Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.

**WAGNER MOTORS**
*...The choice of leaders in industry*

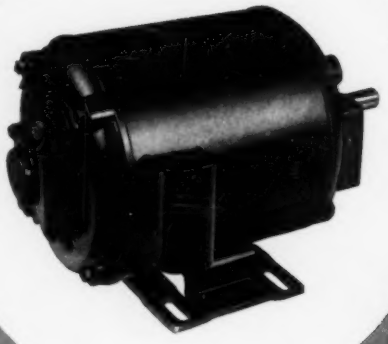
# Here's what you get in the WAGNER *Type RA* MOTOR...

***the most simplified design to provide—***

## repulsion start

**HIGH STARTING TORQUE** . . . for quick, easy starting and smooth acceleration.

**LOW STARTING CURRENT** . . . to minimize light flicker when motor starts.

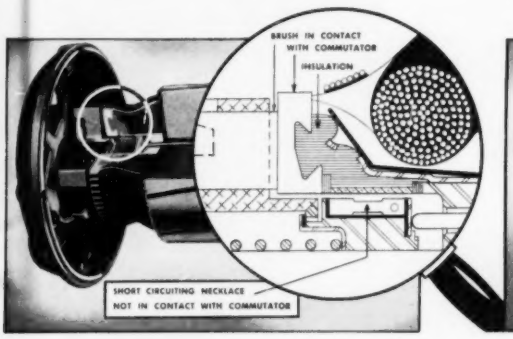


## induction run

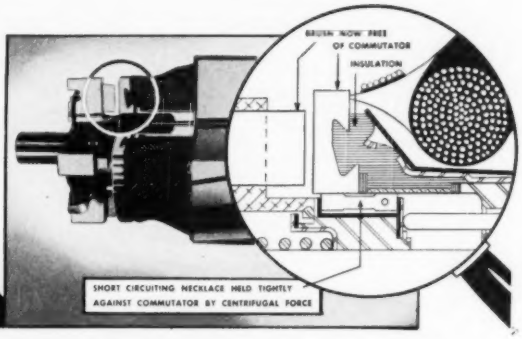
**HIGH OPERATING SPEED** . . . constant at all operating loads, even under overload.

**FLAT EFFICIENCY CURVE** . . . over a wide operating range.

Pioneered by Wagner more than half a century ago, the repulsion-start induction single phase motor is truly industry's "general purpose" motor because it combines the best features of two types of motors: the repulsion motor during the starting period and the induction motor while running at rated operating speeds. Today, the Wagner Type RA offers the most simplified, trouble-free design available, and is still the standard by which all other single phase motors are judged. In the Wagner Type RA Motor you get low upkeep cost, minimum servicing, freedom from vibration and noise, and years of reliable service. Shown below are the basic principles of operation of this motor. Bulletin MU-185 gives complete details. Write for a copy.




**Starting period**—Short-circuiting necklace is not in contact with commutator bars. A governor spring holds barrel in starting position. Brush assembly completes selected circuits enabling motor to start as a repulsion motor.


BRUSH NOW FREE OF COMMUTATOR
INSULATION
SHORT CIRCUITING NECKLACE HELD TIGHTLY AGAINST COMMUTATOR BY CENTRIFUGAL FORCE

**Running period**—Governor weights (actuating pushrods) have forced spring barrel forward until short-circuiting necklace connects commutator bars to short-circuiting ring, forming a "squirrel cage" to permit operation as an induction motor.

**Wagner Electric Corporation**
EST. WE 1891

**WAGNER ELECTRIC CORPORATION**
**6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.**

ELECTRIC MOTORS · TRANSFORMERS · INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

**BRANCHES IN 29 PRINCIPAL CITIES**

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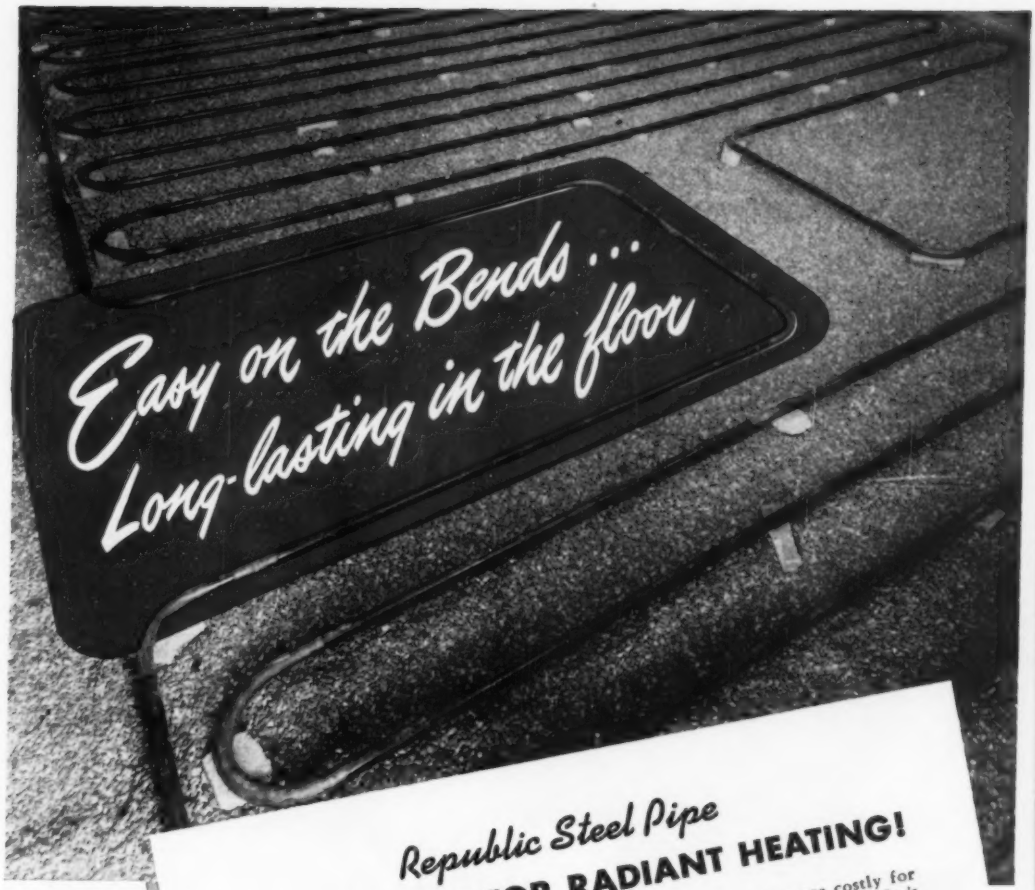



## *Republic Steel Pipe*
## IS JUST RIGHT FOR RADIANT HEATING!

It is made to ASTM Specification A53, by Republic's own *improved* Continuous Weld Process. Thus, it is highly ductile, easy to fabricate, suited to close coiling and bending.

It comes to you in long lengths that speed installation by reducing the number of joints. You can weld it readily to tight, leak-proof joints by all modern methods.

How about long life? For many years steel pipe has been standard for closed system heating lines. Its trouble-free record proves that you need nothing more costly for closed radiant heating systems. And, today's Republic Steel Pipe is improved in many ways over that which served so well twenty years ago.

See your Republic Pipe Jobber soon. He'll be happy to give you latest information on available sizes and current delivery schedules.

**REPUBLIC STEEL CORPORATION**
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Dept.: Chrysler Bldg., New York 17, N.Y.

**REPUBLIC CONTINUOUS WELD PIPE**

Uniformly Strong
Uniformly Ductile
Uniformly Clean and Scale Free
Easy to Weld by All Modern Methods
Easy to Bend, Thread and Close Coil
Economical Uniform Lengths, Extra Long Lengths
Uniform Wall Thickness, Diameter, Concentricity
Expansion Co-efficient Same as Concrete and Plaster

*Republic* REPUBLIC STEEL ®
**STEEL PIPE**
IS FIRST CHOICE

ANOTHER SCOOP!

NUMBERS 175 AND 250

# SAFETY RELIEF VALVES

## ASME

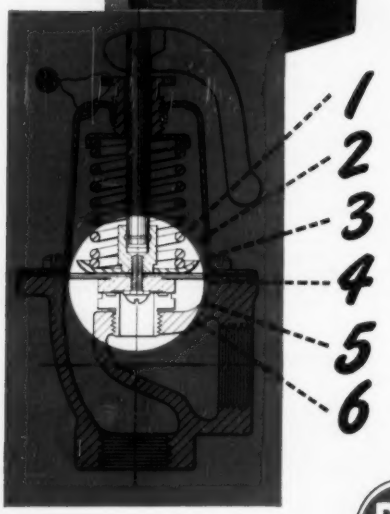
**CAPACITY RATED**

**At 175,000 BTU and 250,000 BTU**

**Matched to the load!**

**These valves are designed to their respective capacities to permit matching of the relief valve to the boiler load. Matching a relief valve to a hot water heating system's requirements eliminates the possibility of noise, yet affords full protection.**

*PLUS....*




## ALL THESE FEATURES IN EXCESS OF ASME CODE REQUIREMENTS

Not a "pop" type valve! Diaphragm operation transmits more power during opening and closing of valve. Diaphragm also seals spring chamber against possible corrosive action of discharge water.

No guides on discharge side of valve to stick or jam.

Establishes a new standard in low differential between opening and closing pressures! This is important if boiler is at a high temperature, as dropping the boiler pressure considerably below that at which the boiler water will flash into steam can create an annoying hammering condition.

Ground and polished metal-to-metal seats.

Under normal operating conditions, thermal expansion within the system lifts the valve just far enough to discharge water at a low rate of flow.

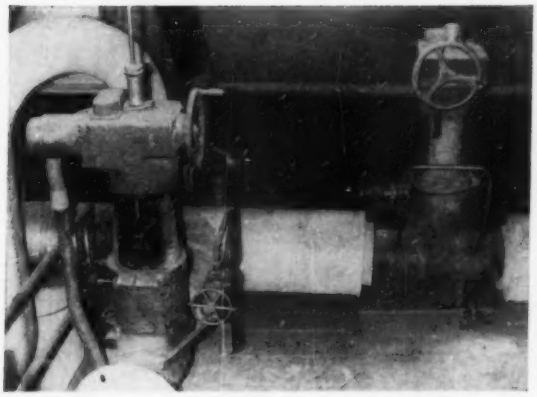
Under emergency conditions, the valve is opened wide to its full rated capacity.

**Ask your wholesaler**

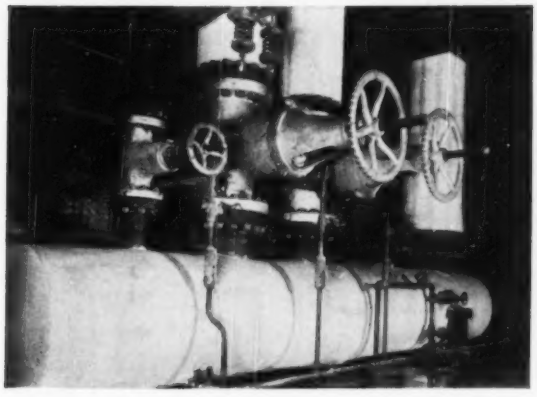
**BELL & GOSSETT Company**

**Dept. BL-5, Morton Grove, Ill.**

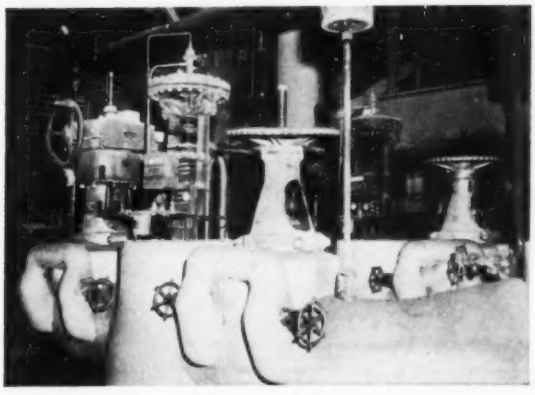
*Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Dr., Toronto 13*



Walworth Motor Operated Series 900 Pressure-Seal Cast Steel Gate Valves.



Walworth Series 600 Pressure-Seal Cast Steel Gate Valves.



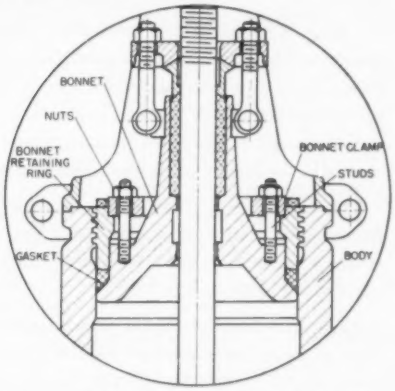
Manually operated and motor operated Walworth Series 900 Pressure-Seal Cast Steel Gate Valves.

# WALWORTH
# PRESSURE-SEAL
## CAST STEEL VALVES

The bonnet and body design of Walworth Pressure-Seal Valves is such that the pressure within the valve is used to prevent leakage at the junction of the bonnet and body. Sudden temperature and pressure changes do not affect this tightness. Bonnet flanges and studs are eliminated and the weight of the valve is reduced.

An improved disc design provides flexibility, and helps keep seats tight, even when the valve body may be distorted by pipeline stresses, or by temperature and pressure changes. This improved disc design makes it easier to open and close this valve.

Walworth Pressure-Seal Valves are easy to disassemble and assemble, and are the most satisfactory valves for high-pressure, high-temperature service. They are available in Series 600, 900, and 1500 and in a wide range of sizes and types. For further information, see your nearest Walworth Distributor, or write: Walworth Company, 60 East 42nd Street, New York 17, N. Y.




A cross section of the bonnet joint assembly of a Walworth Pressure-Seal Cast Steel Gate Valve. The internal pressure is utilized to make the body-to-bonnet joint tight.

**WALWORTH**
**valves and fittings**
**60 EAST 42nd STREET, NEW YORK 17, N. Y.**

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

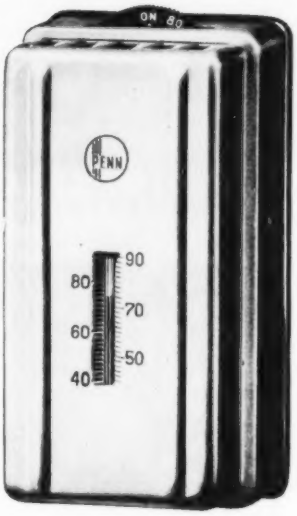
# "UNIT HEATERS Need UNIT CONTROL"

That's right! For greater year 'round efficiency, equip *each unit heater* with a PENN heat-anticipating thermostat featuring the *built-in "on-off" switch.* Then, you can have accurate, economical individual temperature control for each department or section of the plant.

The PENN unit heater thermostat is a great fuel saver during winter months. First, through the famous PENN heat-anticipating principle, the thermostat holds temperatures closely to the selected level . . . wide swings and over-runs are eliminated. Second, the "on-off" switch prevents heat from pouring into areas where it's not required. A mere rotation of the dial to "off" position stops heat flow during idle periods . . . or to little-used areas . . . or to areas exposed for long periods to outside temperatures such as receiving or shipping rooms.

This same "on-off" feature permits manual control of fan operation for summer ventilation *without* installing an additional switch. By rotating the dial to "on" position, it causes continuous operation of unit blower whenever desired.

Learn more about this *better control* for unit heaters. Ask your wholesaler or write **Penn Electric Switch Co., Goshen, Indiana.** Export Division: 13 E. 40th Street, New York 16, U.S.A. In Canada: Penn Controls, Ltd., Toronto, Ont.



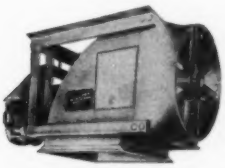

PENN AUTOMATIC CONTROLS

**FOR HEATING, REFRIGERATION, AIR CONDITIONING, PUMPS, AIR COMPRESSORS, ENGINES, GAS RANGES**

# WING VENTILATING EQUIPMENT

## WINGFOIL SAFETY VENTILATING FAN

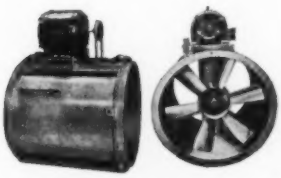
Distinguished for efficiency and rugged construction. The new Wingfoil fan wheel moves maximum volumes of air with minimum horsepower, due largely to its non-overloading feature. Sizes from 10" to 60" dia., with free air capacities from 825 to 59,000 CFM. Larger sizes on special order. Either direct or belt drive. Heavy steel guards provide safety.



## WINGFOIL DUCT FAN

**(Elbow Type)**

Designed to form an elbow in the duct system, the elbow-shaped housing in a strong rectangular frame permits installation with the inlet in any desired position. Motor and drive are outside the air stream, therefore remain cool, clean, and easily accessible. The new Wingfoil Fan has a remarkable "non-overloading" characteristic. Sizes 10" to 60"; capacities up to 85,000 CFM.



## WINGFOIL DUCT FAN

**(Straight Line Type)**

Designed to form a part of any straight run of duct. The motor is mounted on an adjustable base outside of the housing. V-belt drive is through an air tube carried across the housing and supporting fan shaft and bearings. Fan wheel is the new non-overloading Wingfoil Fan. Bearings are grease-sealed, requiring minimum of attention.

***WRITE FOR BULLETINS***

## Only Wing Revolving Heaters Circulate the Heated Air Around Obstructions

Industrial plant heating reaches its highest peak of perfection in the Wing Revolving Discharge Unit Heater. Unlike stationary discharge unit heaters, which project heated air in one or more fixed directions, the Wing Revolving Discharge outlets move slowly through a complete arc, flooding the entire heating area with a blanket of fresh, live warmth. The gentle air motion caused by the constantly changing directions of the heated air from the revolving discharge outlets eliminates the hot blasts and chilly areas common with stationary discharge type unit heaters—creates a refreshing, stimulating atmosphere beneficial to employee morale and productivity.

Successful applications of Wing Revolving Heaters have been made in every type of industrial plant, as well as other buildings with unique heating problems. Get complete information on this modern form of unit heating by writing today for a copy of Wing Bulletin HR-5.

**L. J. Wing Mfg. Co.**

**Executive Offices and Factory: 140 Vreeland Mills Road, LINDEN, N. J.**

*Canadian Factory: Montreal, Canada*

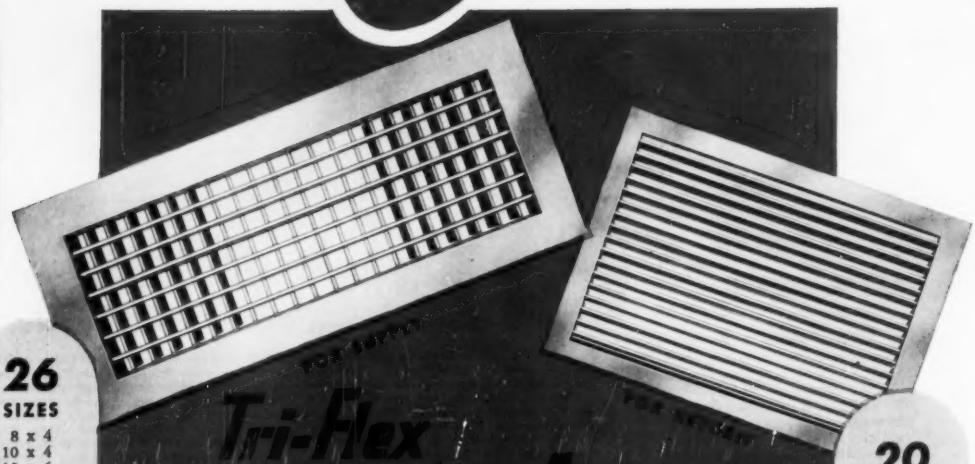
Manufacturing Licensee for Wing Unit Heaters in Western Europe—ETABLISSEMENTS WANSON—9, rue Mogador, Paris 9e, France Nouveau Boulevard de la Woluwe, Haren-Nord, Brussels, Belgium.

**Wing**

**Revolving UNIT HEATERS**

# 26 & 20

**FOR ECONOMY**
**FOR QUICK SELECTION**
**FOR PROMPT DELIVERY**



**26 SIZES**

8 x 4
10 x 4
10 x 6
12 x 4
12 x 5
12 x 6
14 x 4
14 x 5
14 x 6
16 x 5
16 x 6
20 x 5
20 x 6
20 x 8
24 x 5
24 x 6
24 x 8
24 x 10
24 x 12
30 x 6
30 x 8
30 x 10
30 x 12
36 x 8
36 x 10
36 x 12

**Tri-Flex** **Aerovane**

**FOR ECONOMY . . .**
size standardization of Tri-Flex and Aerovane Grilles and Registers has resulted in efficient mass production methods that mean real savings.

**FOR QUICK SELECTION . . .**
size standardization has simplified the specification of grilles and registers to meet normal job requirements.

**FOR PROMPT DELIVERY . . .**
size standardization means on-the-shelf stock . . . job completion without costly delays.

And, all standard items are individually packaged in sturdy cartons for protection . . . for handling convenience. Easy-to-read labels facilitate sorting and locating.

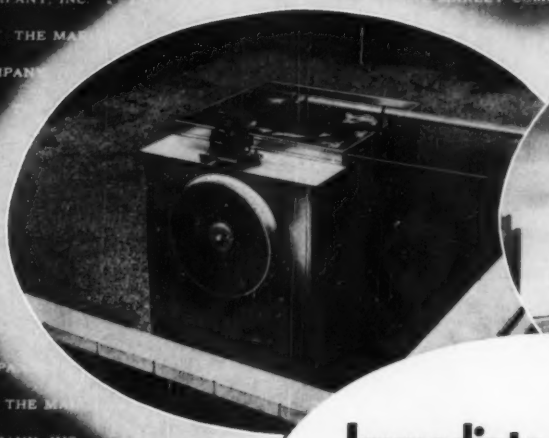
For complete details and engineering data, write for a copy of Catalog 48.

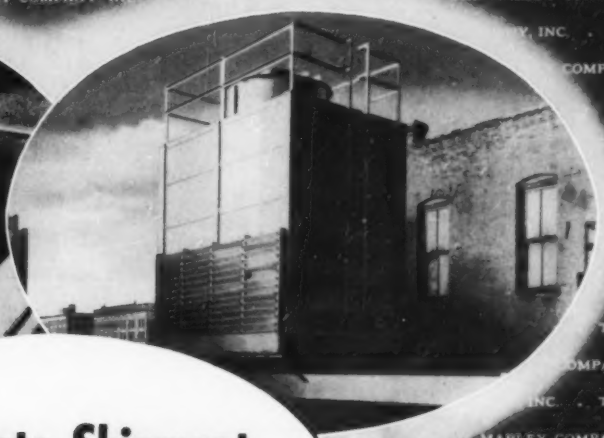
TUTTLE & BAILEY INC
NEW BRITAIN, CONNECTICUT

**20 SIZES**

10 x 6
10 x 8
12 x 6
12 x 8
12 x 12
18 x 6
18 x 12
18 x 18
24 x 12
24 x 18
24 x 24
30 x 12
30 x 18
30 x 24
36 x 18
36 x 24
36 x 30
48 x 24
48 x 30
48 x 36

17B50





# Immediate Shipment Vairflo . . . Aquatower *Which Do You Need?*

TWO great cooling towers . . . well designed, well built, packed with years of rugged, economical performance . . . available for IMMEDIATE SHIPMENT.

Which do YOU need?

The AQUATOWER . . . a packaged, steel, cooling tower, completely assembled, ready to go—with a guaranteed capacity from 3 to 50 tons of refrigeration, sized to serve your packaged air conditioning units. Can be installed indoors or outdoors. Open distribution water basin. Interior treated to resist corrosion. Grease packed ball bearings. Special, deep pitch, slow speed, quiet fan. Packed with heart quality California redwood filling. Bulletin AQ-50.

The VAIRFLO . . . a medium capacity tower designed especially for air conditioning and refrigeration service. Includes "extra quality," heavy duty features found formerly only on large industrial cooling towers. Because these towers are mass produced, these "extra quality" features are included at no extra cost. Totally enclosed motor, lifetime nail-less filling. Marley designed cooling tower fan, grease packed totally enclosed bearing housing, balanced multi-nozzle spray distribution system, extra heavy framing and bracing, complete basin fixtures. Available in all-steel, all-redwood or asbestos board casing. Bulletin V-50.

Call in a Marley Application Engineer to help you solve your cooling problems in the "blue-print" stage. Marley "know-how" will help you select the best type cooling tower for your job. Write, wire or phone Marley today. No cost. No obligation.

**MAIL THIS COUPON TODAY**

**The Marley Company, Inc., Kansas City 15, Kansas**

☐ Send Bulletin V-50 ☐ Send Bulletin AQ-50

☐ Mail "What's Your Cooling Tower I.Q.?" FREE, illustrated folders on Cooling Tower Operation, Maintenance, Specifications, Water Distribution, Water Treatment, etc.

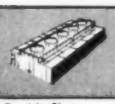
☐ Have Marley engineer call. HP-4

Name _____ Title _____

Address _____

City _____ Zone _____ State _____

MARLEY


Double-Flow

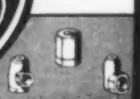
Vairflo

DriCooler

Natural Draft

Counter-Flow

Aquatower


Spray Nozzles

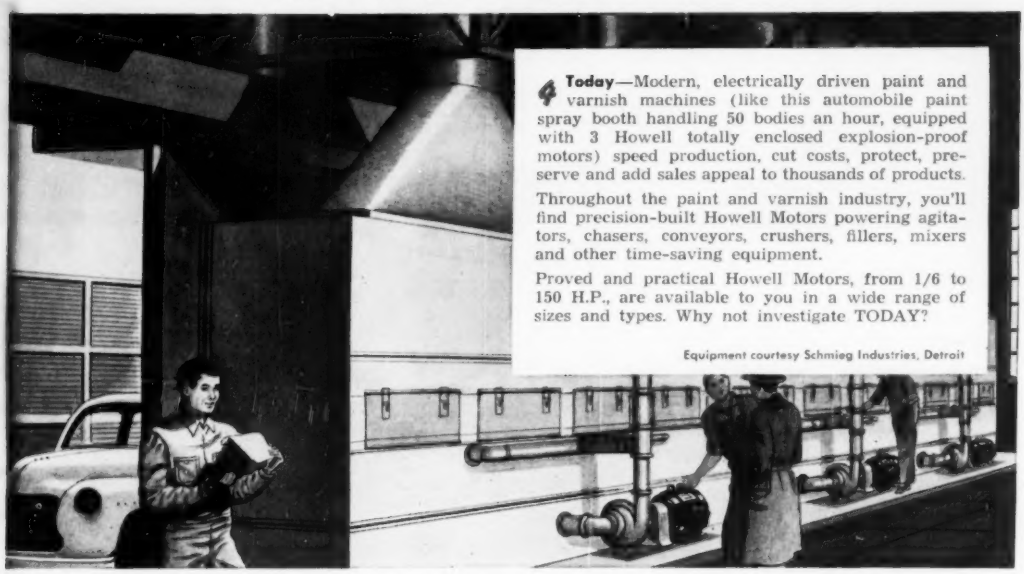
**1** **1875**—For centuries, hard labor and a paintbrush were man's main means of adding beauty and color. But, with the industrial revolution at hand, new devices were sorely needed to break this bottleneck.

**2** **1900**—The artist's airbrush was born. On its heels came the paint spray gun. Both products, strangely enough, stemmed from the atomizer used by doctors to prevent colds. Painting swung into high gear.

**3** **1915**—Portable paint-spraying equipment was introduced in this, the year Howell "Red Band" Electric Motors arrived. Soon these rugged motors made important contributions to this and other industries.

# PAINT . . . protects, preserves, decorates and sells!

**(AND HOWELL MOTORS HELP SPEED MODERN PAINTING PROCESSES — CUT COSTS)**



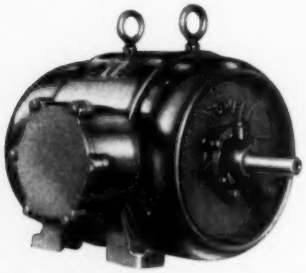
**4** **Today**—Modern, electrically driven paint and varnish machines (like this automobile paint spray booth handling 50 bodies an hour, equipped with 3 Howell totally enclosed explosion-proof motors) speed production, cut costs, protect, preserve and add sales appeal to thousands of products.

Throughout the paint and varnish industry, you'll find precision-built Howell Motors powering agitators, chasers, conveyors, crushers, fillers, mixers and other time-saving equipment.

Proved and practical Howell Motors, from 1/6 to 150 H.P., are available to you in a wide range of sizes and types. Why not investigate TODAY?

Equipment courtesy Schmieg Industries, Detroit

*Free enterprise encourages mass production, supplies more jobs—provides more goods for more people at less cost.*



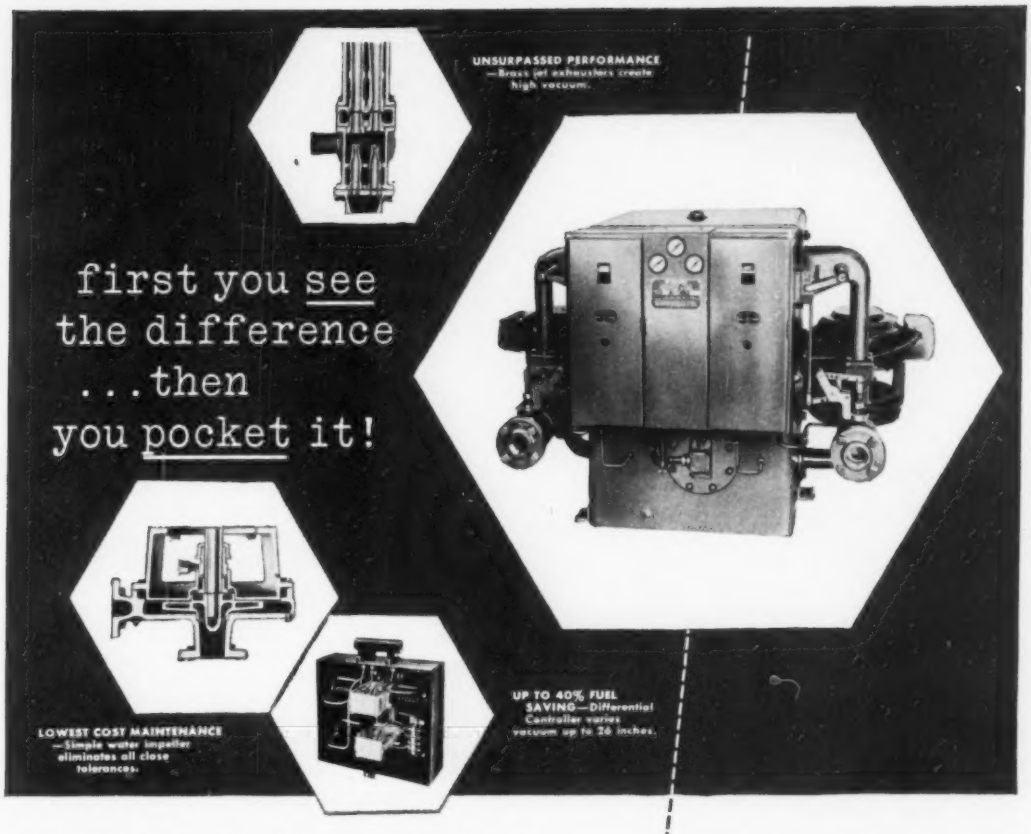
Howell totally-enclosed, explosion-proof motors for use where inflammable liquids or gases are handled or stored.

## HOWELL MOTORS

**HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.**

***Precision-built Industrial Motors Since 1915***

HOWELL Red Band MOTORS


UNSURPASSED PERFORMANCE
—Brass jet exhausters create high vacuum.
first you see the difference ...then you pocket it!
LOWEST COST MAINTENANCE
—Simple water impeller eliminates all close tolerances.
UP TO 40% FUEL SAVING—Differential Controller varies vacuum up to 26 inches.

**DUNHAM VACUUM PUMPS step up steam circulation... lower fuel costs.** Your customers get more heat for their money when you install a Dunham Vacuum Pump. *Designed to pull up to 26 inches of vacuum,* these pumps easily handle the requirements of any steam heating system. Provide better circulation and control of steam . . . shorten "heating up" periods.

Dunham Vacuum Pumps are extremely simple and compact in design. The only principal moving element is the water impeller. Flow of water through the exhauster jets creates high vacuum... maintains positive pressure to discharge condensate direct to boiler. There are no moving parts under vacuum . . . no close tolerance parts to slip out of adjustment.

Available as single or duplex units—in a full range of capacities to meet most heating demands. Dunham Vacuum Pumps are ready for immediate operation on delivery.

**These Pumps Help Dunham Differential Heating Cut Fuel Costs up to 40%**
These pumps are the heart of the famous Dunham Vari-Vac* Heating System . . . the precision temperature control system that, for example, has enabled the Millard Fillmore Hospital, Buffalo, N. Y., to save 37.8% annually on steam consumed since 1935.

***SEND FOR THIS FREE BULLETIN!***

Write today for your free copy of File No. 4C-2-8, giving complete facts and figures about these cost-saving Vacuum Pumps and other Dunham Heating Products. C. A. Dunham Co., 400 W. Madison St., Chicago 6, Ill. *In Canada:* C. A. Dunham Co., Ltd., Toronto. *In England:* C. A. Dunham Co. Ltd., London. *Sales Engineers and Jobbers in All Principal Cities.*

**Variable Vacuum*

***FROM A SINGLE TRAP... TO A COMPLETELY ENGINEERED SYSTEM...***

**DUNHAM**

**HEATING MEANS BETTER HEATING**

**Super-7 Texrope**
**A and B Belts**

Powerful cord structure impregnated with live rubber, extra stiffening plies, resilient rubber cushion, tough, double-wrapped, bias-cut cover, precision molded, accurately matched.

**Super-7 Texrope**
**C, D, and E Belts**

Famous grommet construction, no splices where failure can start, heavy rayon cord, rubber cushion supports cords at pitch line, bias-cut double-wrapped cover has high wear resistance, accurately molded, matched under load.

# *LONG LIFE* FOR YOUR DRIVES

YOU GET MORE than good belts when you standardize on *Super-7 Texrope* V-belts in your plant. You also get the benefit of the greatest V-belt experience in the world. This means you are sure of exactly the right drive for longest life on your job. *Texrope* Drive Department of Allis-Chalmers originated the multiple V-belt drive and there are more *Texrope* multiple V-belt drives in operation than any other make.

### High Capacity Belts

These belts have extra strong cords, special rubber cushion and tough neoprene cover to give them 40% greater capacity than standard belts at proportionately higher price. Recommended only for applications where space is limited or other special conditions demand a heavier duty belt. Made in A, B, C, D and E sections.

### Complete V-belt Service

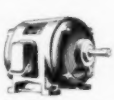
Get everything you need for your V-belt drives . . . new and replacement V-belts, standard and variable speed sheaves and speed changers . . . from one reliable source. 144 page *Texrope* Pre-engineered Drive manual covers 90% of requirements. Get your copy today from your A-C Authorized Dealer or Sales Office or write for Bulletin 20B6956.

*Texrope* and *Super-7* are Allis-Chalmers trademarks. *Super-7 Texrope* V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices.

ALLIS-CHALMERS, 1171A SO. 70 ST. A-3021
MILWAUKEE, WIS.

**Sold . . .**
**Applied . . .**
**Serviced . . .**

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.



MOTORS — ½ to 25,000 hp and up. All types.

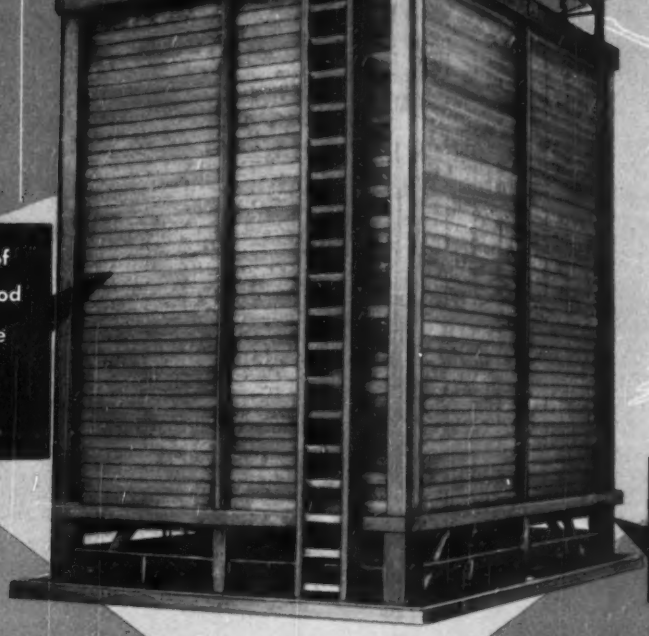
CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

# ALLIS-CHALMERS

# water supply limited?

## a FOSTER WHEELER "package" cooling tower supplies the need—



CASING of
Redwood
Transite
Metal
or
Brick

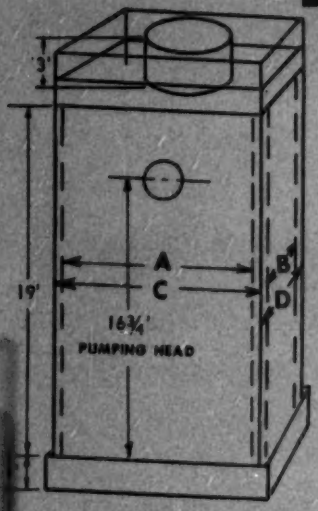
STRUCTURE of
Redwood
or
Steelwork

Do you have a water cooling problem? If it is your office building, department store, chemical plant or any other type of industrial establishment or institution, Foster Wheeler offers a "Package" Cooling Tower which can reduce your present cooling water consumption to a mere 2%.

FOSTER WHEELER

## Principal dimensions of standard package cooling towers

*for capacities from 75 to 750 gpm*




| A | B | C | D |
|---|---|---|---|
| 6 | 6 | 7 | 7 |
| 8 | 8 | 9 | 9 |
| 8 | 12 | 9 | 13 |
| 12 | 12 | 13 | 13 |
| 12 | 16 | 13 | 17 |

Height of all towers 19' from basin curb.
Fixed static pumping head 16¾'.
Fan ring and railing height 3'.

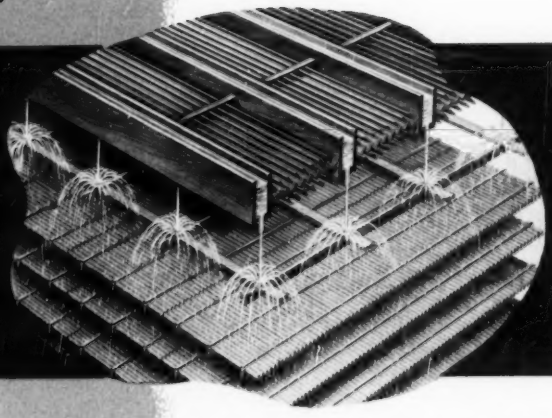
**GRAVITY DISTRIBUTION SYSTEM**

•

**NO SPRAY NOZZLES TO CLOG**

•

**REMOVABLE FILL RACKS**



**ADJUSTABLE PITCH FAN BLADES**

•

**STRUCTURE DESIGNED FOR 100 MPH WIND**

•

**QUIET OPERATION**

***A variety of structural and casing materials is available to meet your particular requirements.***

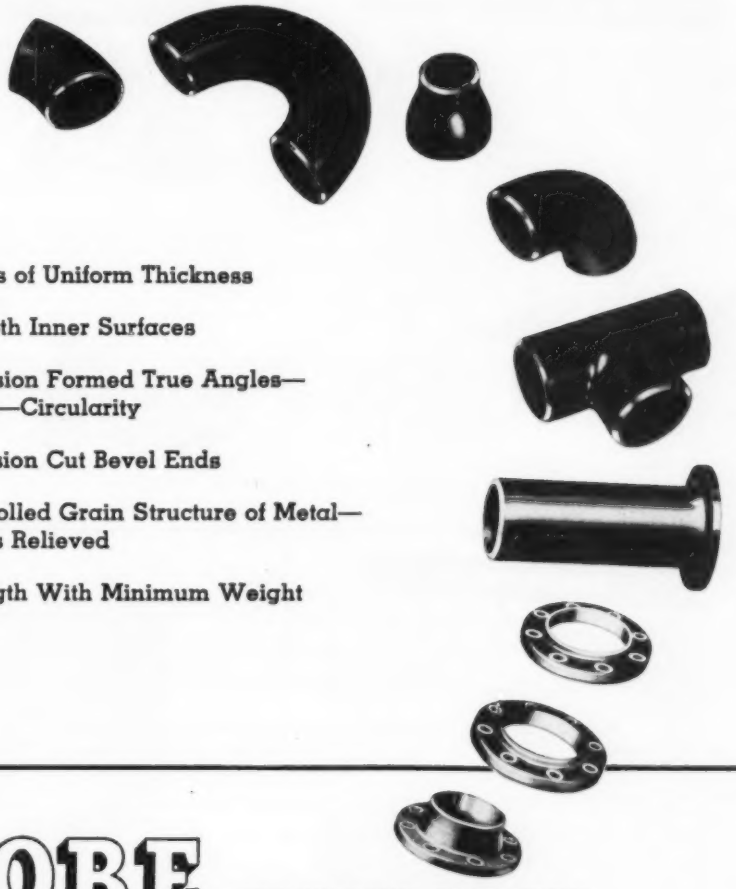
Your best guarantee for a constant supply of cooling water for air conditioning, processing, or other uses, is a Foster Wheeler Cooling Tower. Regardless of size, the same engineering "know how", the same attention to detail and the same quality of materials go into every installation.

*For further information, write to:*

**FOSTER WHEELER CORPORATION**

165 Broadway New York 6, New York

**CONNECT WITH THESE ADVANTAGES IN YOUR PIPING CONNECTIONS . . .**



- ★ Walls of Uniform Thickness
- ★ Smooth Inner Surfaces
- ★ Precision Formed True Angles—Radii—Circularity
- ★ Precision Cut Bevel Ends
- ★ Controlled Grain Structure of Metal—Stress Relieved
- ★ Strength With Minimum Weight

# GLOBE PRECISION PROCESS SEAMLESS WELDING FITTINGS

All of these advantages are yours in Globe Welding Fittings. Globe's metallurgical experience and highly specialized production and processing facilities are utilized beginning with the production of Globe seamless steel tubes and continuing through every step to the finished Globe Welding Fittings.

GLOBE STEEL TUBES CO., Milwaukee 4, Wisconsin
Chicago • Minneapolis • Cleveland • Detroit • New York • Philadelphia
St. Louis • Tulsa • Houston • Denver • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — carbon — alloy — seamless steel tubes — Globeiron seamless high purity ingot iron tubes — Globe Welding Fittings.

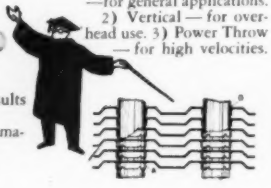
*There's plus value in Globe Welding Fittings — send for the catalog.*

# Things to think about when selecting Unit Heaters

## DISCHARGE AIR TEMPERATURE*

Teeter-totter temperatures are out of the question in buildings heated by Modine Unit Heaters. Modine's *right* combination of correct outlet temperature and sufficient air velocity heats all parts of a room uniformly, even in coldest weather.

Modine's wide line gives you the right unit for your needs: 1) Horizontal —for general applications. 2) Vertical — for overhead use. 3) Power Throw — for high velocities.



Higher heat transfer results from quality Modine construction which permanently seals flanged collars of fins (A) to tubes (B) by means of metallic bond.

**For maximum comfort and lowest operating cost, temperature of air leaving unit heater should be between 110°-120°F. at standard conditions.*

## LOWER COSTS

Fuel bills shrink when you heat with Modines. Here's why. Modine Unit Heaters — combining correct outlet temperatures with sufficient air velocity — deliver heat down into comfort zones where it's needed . . . don't waste it on ceilings or above the heads of room occupants.

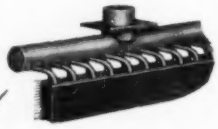
Direct-from-pipe suspension is safe and practical with Modine horizontal models. *This cuts installation costs . . . permits easy redirection of heat over a 360° range.*

*Lower power and motor maintenance costs* result from Modine's use of only high-quality, totally enclosed split-phase or capacitor motors on all but only the smallest Modine Unit Heaters.

## LONGER LIFE

Modine Unit Heaters are built to last. With the complete condenser constructed of pure copper and copper alloy . . . with tubes of red brass, fins and headers of copper, you get maximum resistance to electrolysis and corrosion.

Differential expansion stresses are safely absorbed in individual tubes. Fins are permanently bonded to tubes with metal. All condenser joints are brazed.



Parker-Bonderizing protects casings and sheet metal parts against formation and spread of rust. Anchors paint to steel. Prolongs original attractive finish.

# Modine
## UNIT HEATERS

**Yes . . . look beyond BTUs** when buying Unit Heaters. Look to Modine! You can get all the facts by calling your nearest Modine Representative. He's listed in the classified section of your phone book. Or write direct. Modine Mfg. Co., 1509 Dekoven Ave., Racine, Wisconsin.

***Ask for the new Modine Unit Heater Bulletin 149A. Also available on special request is the informative booklet — "Here's How to Evaluate Operating Characteristics of Suspended Unit Heaters." Send for them today!***

U-1037

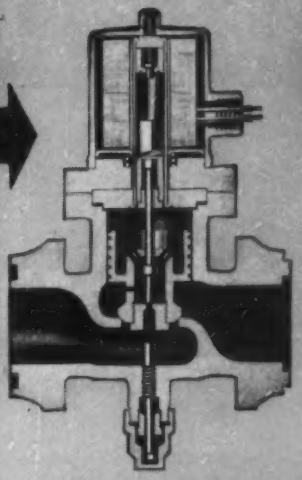
# BE DOUBLY SURE OF SHUT-OFF!

**Don't depend on continued tight seating of the expansion valve alone . . .**

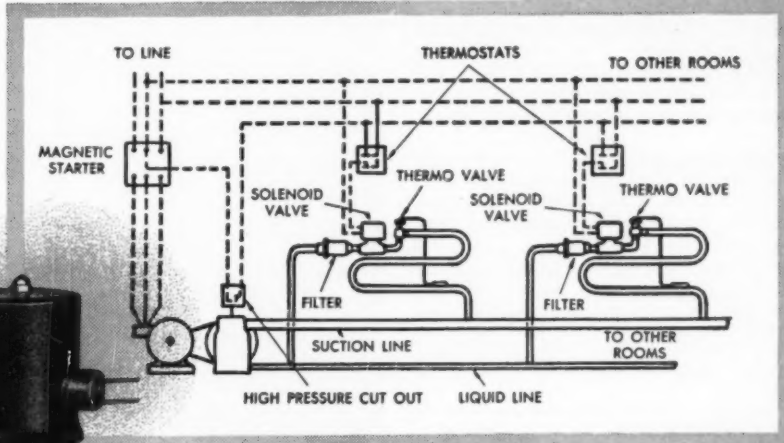
**For POSITIVE liquid shut-off on any size installation use ALCO Solenoid Valves, because:**

1) Accurate machining to extremely close tolerances assures leakproof seating.

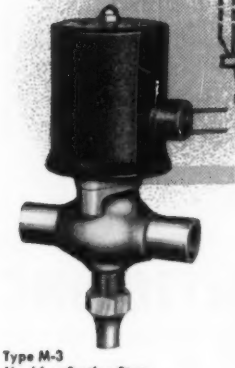
2) ALCO Solenoid Valve coils are made of the finest materials, impregnated with a special varnish giving maximum resistance to moisture, dirt and corrosion.



Type R-1
Liquid or Suction Stop




A diagram of ALCO Solenoid Liquid Stop Valves in a refrigeration system



Type M-3
Liquid or Suction Stop

## ALCO SOLENOID VALVES

A QUARTER-CENTURY OF PIONEERING AND PROGRESS

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

SEE YOUR ALCO WHOLESALER

## ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

4306

BRUNNER SINCE 1906 **AIR CONDITIONING** builds business

## *"Packaged"* AIR CONDITIONING

***. . . as easy to sell as cornflakes!***

Air Conditioners are as much a part of the heating and plumbing contractor's business as cornflakes are a grocery store item...and as easy to sell.

Every business depending upon human traffic for the moving of merchandise recognizes customer comfort as the No. 1 attraction, therefore your potential customers are all those retail type businesses in the area you serve.

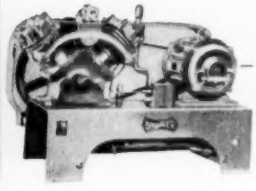
Brunner has the units . . . four popular sizes of self-contained air conditioners that provide you the *right* answers to every question of appearance, price, design, dependability and long self-amortizing service life. And packaged air conditioning is a clean and simple installation job.

● *Your letter requesting literature and complete information will lead the way to another source of good volume and good profits.*

BRUNNER SINCE 1906

## AIR CONDITIONING

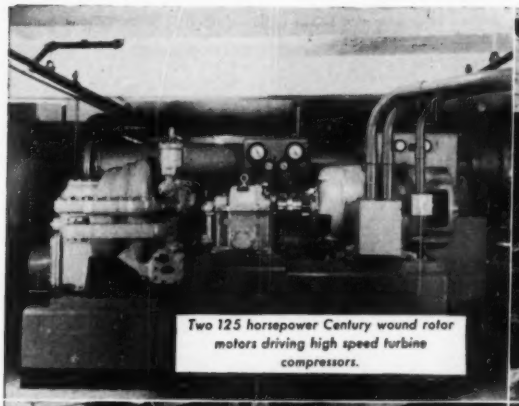
- **Self Contained 3 HP. to 10 HP.**
- **Remote Type 5 HP. to 75 HP.**



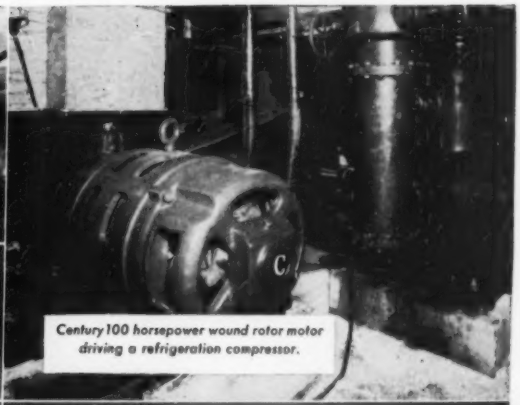
**BRUNNER MANUFACTURING CO., Utica 1, New York, U.S.A.**

**REFRIGERATION CONDENSING UNITS by BRUNNER**

**AIR AND WATER COOLED MODELS**—*a size and type for every purpose...*¼ **HP. TO 75 HP.**



Two 125 horsepower Century wound rotor motors driving high speed turbine compressors.



Century 100 horsepower wound rotor motor driving a refrigeration compressor.

Century 75 and 30 horsepower wound rotor motors driving a bending roll.

Century wound rotor motor.

HERE ARE

# 4 WAYS

TO TAKE ADVANTAGE OF THE

# FLEXIBLE POWER OF

Century

## WOUND ROTOR MOTORS

### *Meet Load Characteristics for:*

1. *Adjustable varying speeds control variable process and other load conditions.*
2. *Reversing direction of operation of heavy loads — as in lift bridges.*
3. *Syncro-speed, multiple drives used where two or more operations must be coordinated.*
4. *High starting torque with low starting current — such as reciprocating compressors, steel plate bending rolls, etc.*

Century wound rotor motors are built in sizes up to 400 horsepower and are available in open protected and splash proof frames. In addition, Century builds a complete line of AC and DC motors in sizes from 1/6 to 400 horsepower for all popular requirements.

Specify Century motors for all your electric power needs.

**ALTERNATING CURRENT MOTORS**

**POLYPHASE**
Squirrel Cage Induction— ¼ to 400 H.P.
Wound Rotor Motors— 1 to 400 H.P.
Synchronous Motors— 20 to 150 H.P.

**SINGLE PHASE**
Split Phase Induction— ⅛, ¼, ⅓ H.P.
Capacitor—¼ to 20 H.P.
Repulsion Start, Brush Lifting, Induction—½ to 20 H.P.

**DIRECT CURRENT MOTORS**
⅛ to 300 H.P.

**GENERATORS**
AC, .63 to 250 KVA
DC, .75 to 200 KW

**MOTOR GENERATOR SETS**
AC to DC, AC to AC
DC to DC, DC to AC

Open Protected, Splash Proof, Totally Enclosed Fan Cooled, Explosion Proof.

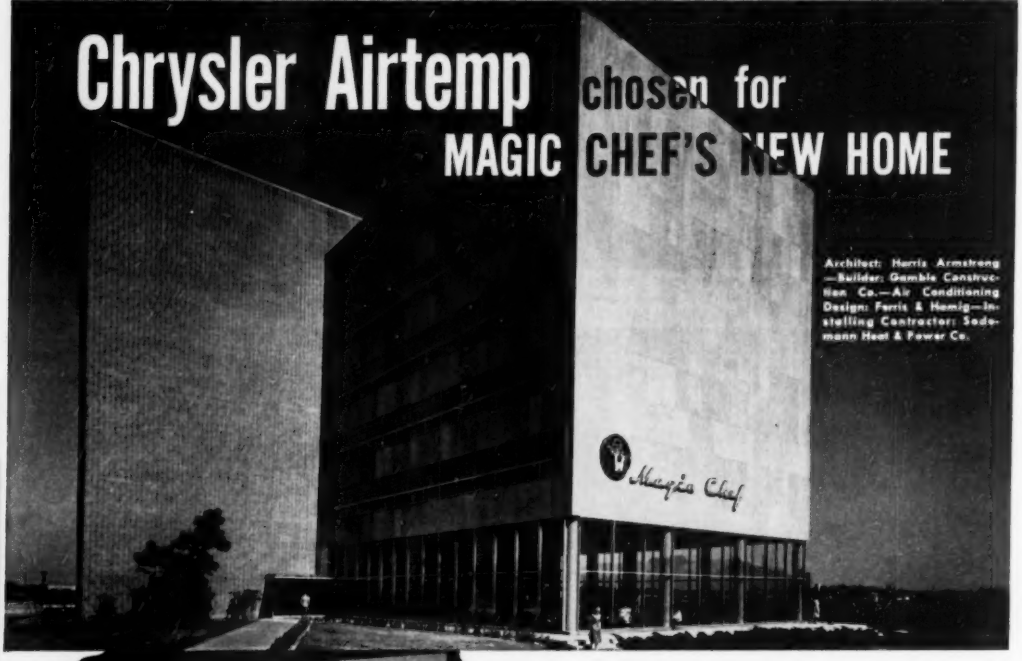
Ball Bearing motors are factory lubricated for several years' normal service. Bearing housing construction permits easy re-lubrication when unusual service demands it.

**CENTURY ELECTRIC COMPANY**
1806 Pine St. • St. Louis 3, Missouri
*Offices and Stock Points in Principal Cities*

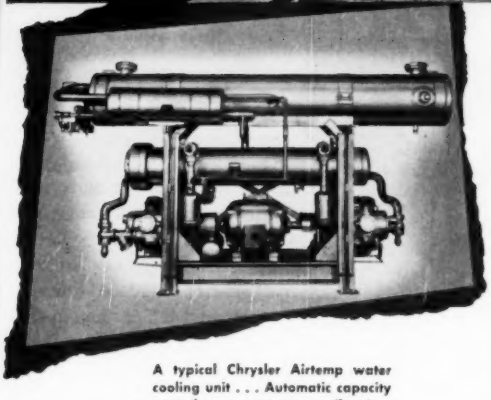
Century C MOTORS

TO BE TRULY MODERN A BUILDING MUST BE AIR CONDITIONED

# Chrysler Airtemp chosen for MAGIC CHEF'S NEW HOME




Architect: Harris Armstrong—Builder: Gamble Construction Co.—Air Conditioning Design: Ferris & Hamig—Installing Contractor: Sodemann Heat & Power Co.



A typical Chrysler Airtemp water cooling unit . . . Automatic capacity control . . . compact . . . vibrationless . . . direct connected . . . no foundations required . . . dynamically balanced . . . can be shipped completely assembled.

## THREE 50-TON CHRYSLER AIRTEMP RADIAL COMPRESSORS CONDITION THE AIR IN THIS FUNCTIONAL OFFICE BUILDING

Modern architecture—with its keynote of sleek beauty combined with efficiency and personal comfort—demands a specialized approach to construction problems. That's why so many architects and builders rely on Chrysler Airtemp equipment and services when planning heating and cooling installations.

Since Chrysler Airtemp builds *three* basic air conditioning systems, we can provide the *best* type to fit each job . . . And, through regional offices, contractors and dealers, Chrysler Airtemp offers the counsel of highly trained engineers. These air conditioning specialists can guide you in selecting the most efficient system for your requirements.

When desired, *Airtemp Construction Corporation*—wholly owned subsidiary of Chrysler Corporation—will assume entire responsibility and follow your project through from specification to completed installation. Mail coupon today for further information.

CHRYSLER AIRTEMP

*Chrysler Airtemp*

AIR CONDITIONING • HEATING • COMMERCIAL REFRIGERATION

AIRTEMP DIVISION OF CHRYSLER CORPORATION, Dayton 1, Ohio
We would like the complete story of Chrysler Airtemp service and products.
HP&AC-4-50

Name_____

Address_____

City_____ Zone____ State_____

3 BASIC SYSTEMS TO MEET EVERY AIR CONDITIONING NEED—
CENTRAL SYSTEMS • INDIVIDUAL ROOM UNITS • "UNITEMP"

## *Here's the*
# RIGHT FORMULA
## *for choosing steam traps*

BE SURE you use the right formula in figuring its cost when you choose a steam trap. Purchase price alone . . . never gives a true cost picture. Figure the installed cost (adding installation and maintenance costs) and you've an honest picture of steam trap costs.

Estimating costs in this manner, Super-Silvertop Steam Traps always assure lower ultimate cost. The conventional trap requires costly fitting and labor to get it installed, while Super-Silvertops fit snugly as a pipe union or elbow . . . saving up to nine fittings plus sixty minutes of installation time. In addition, Super-Silvertops save forty-five minutes whenever you replace a part or clean. Use the right formula in figuring trap costs, and you'll choose Super-Silvertops every time. Write for free copy of "Solving Steam Trap Problems" which gives further information on cutting steam trap costs.

**THE V. D. ANDERSON COMPANY**
1949 WEST 96TH STREET • CLEVELAND 2, OHIO

***MAIL COUPON NOW!***

**WRONG FORMULA**

$X$ = PURCHASE PRICE OF TRAP

$\overline{X}$ = ONLY EXPENSE OF TRAP

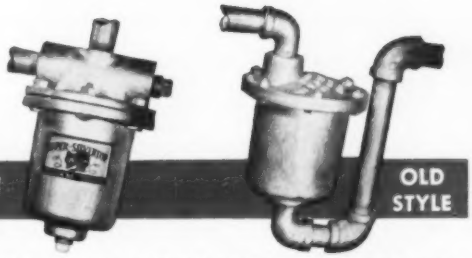
**RIGHT FORMULA**

$X$ = PURCHASE PRICE OF TRAP

$Y$ = COST OF INSTALLING TRAP

$Z$ = COST OF MAINTAINING TRAP

$\overline{X+Y+Z}$ = TOTAL EXPENSE



USE SUPER-SILVERTOP IN-LINE OR AS AN ELBOW

OLD STYLE

**Save Money With SUPER-SILVERTOPS**

**THE V. D. ANDERSON COMPANY**
1949 WEST 96TH STREET • CLEVELAND 2, OHIO

Send me a copy of the booklet, "Solving Steam Trap Problems."

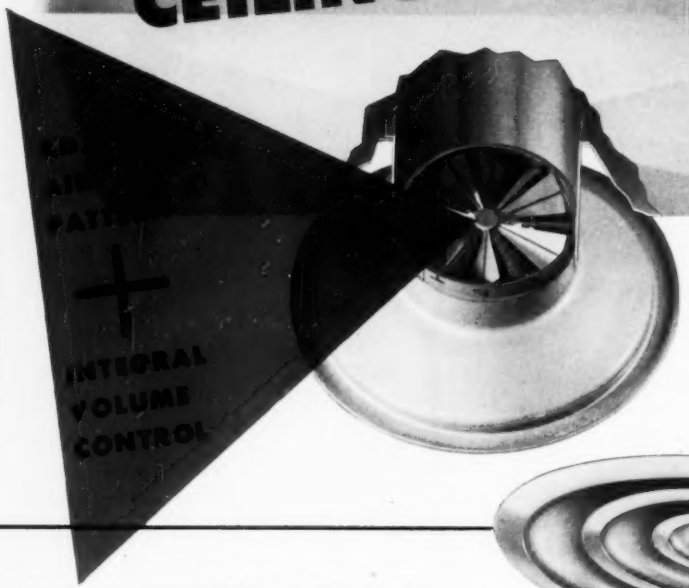
*Name* .....

*Address* .....

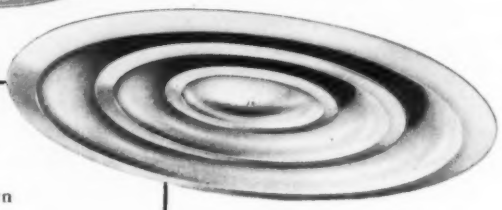
*City* ..... *State* .....

*In Canada: Bowden Machine Co., Toronto*

# venturi-flo
## CEILING OUTLETS




**MODEL "J"**



Model "J" VENTURI-FLO Ceiling Outlets are available with a built-in volume control as shown above. Blades are gang-operated and opposed-blade design provides positive air control and uniform distribution of air in throat of outlet. A concealed adjusting lever is accessible after unit is placed in service. Model "J" Ceiling Outlets provide adjustable air pattern over a wide range by means of a key socket which raises or lowers the inner assembly.

*For full information, see your Barber-Colman representative or write for Bulletin F-4085.*

- LOW NOISE LEVEL
- LOW PRESSURE DROP
- ENGINEERED FOR COMFORT CONDITIONING
- FLUSH MOUNTING
- SUPPLY AND EXHAUST
- COMPLETE RANGE OF SIZES

BARBER COLMAN

**BARBER-COLMAN COMPANY, 1228 Rock St., Rockford, Illinois**

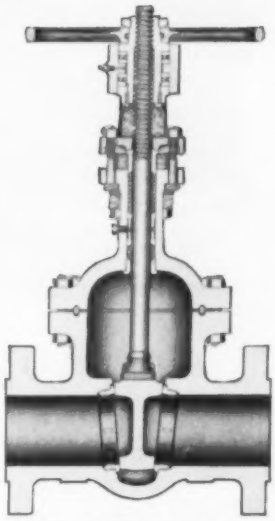
# For the best in power piping...
# Look to the complete CRANE line

## STEEL VALVES FOR GENERAL STEAM SERVICES

You can count on Crane Cast Steel Wedge Gate Valves for dependable performance under the most severe service conditions. Straight-through ports minimize turbulence, erosion and resistance to flow. Long, close-fitting disc guides assure tight seating.

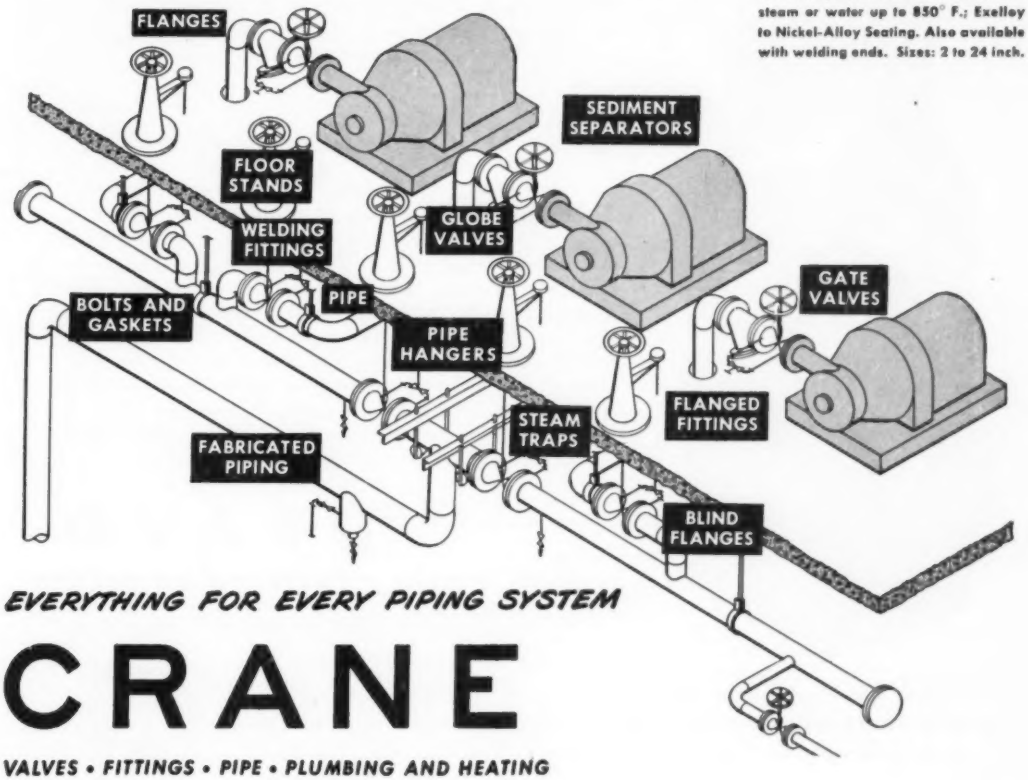
Strong tee-head disc-stem connection, easily lubricated yoke bushing, and ample bearings provide smooth operation. Made of Carbon or Alloy Steel suitably trimmed for pressures and temperatures up to 2500 pounds at 1000° F. Available with flanged, screwed, or welding ends. See your new No. 49 Crane Catalog.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
*Branches and Wholesalers Serving All Industrial Areas*



No. 76XR, 600-Pound Steel Gate. For steam or water up to 850° F.; Exelloy to Nickel-Alloy Seating. Also available with welding ends. Sizes: 2 to 24 inch.

**THIS STEAM TURBINE PIPING INSTALLATION CAN BE 100% CRANE ON ONE PURCHASE ORDER**




***EVERYTHING FOR EVERY PIPING SYSTEM***

# CRANE

***VALVES • FITTINGS • PIPE • PLUMBING AND HEATING***

# employee heating comfort is measured "by the FOOT."

When it comes to keeping employees comfortable and at top efficiency, one Btu below the knees is worth 100 above the head. That's why it is good business to insist on

## DRAVO *Counterflo* HEATERS

Dravo *Counterflo* Heaters banish floor chills; each unit blankets from 4,000 to 20,000 square feet of working area with warmth. The recirculation principle of Dravo *Counterflo* Heaters tends to hold the warm air at the working level, thus reducing roof heat loss and saving fuel dollars. Air throw 100-150 feet; no ducts needed for open areas. Users report first cost 50 to 66% less than wet-type systems. No fuel worries; oil or gas-fired, readily converted from one to other. 80-85% efficiency. Units furnish ventilating air in summer. Immediate deliveries, easy installation. Ask for Bulletin EF-523-576.

**DRAVO**
CORPORATION
DRAVO BUILDING, PITTSBURGH 22, PA.

Dravo also manufactures the *DRAVO CRANE CAB COOLER* for air conditioning hot-metal crane cabs.

**PITTSBURGH • CLEVELAND • PHILADELPHIA • DETROIT • NEW YORK • CHICAGO • ATLANTA • BOSTON**

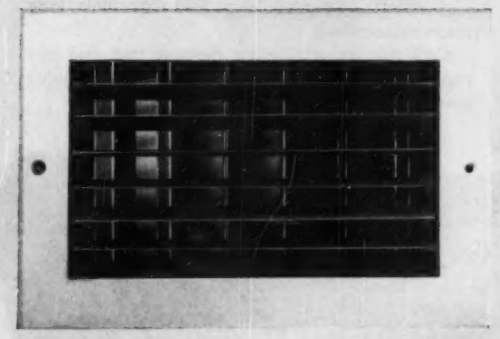
Sales Representatives in Principal Cities. Mfd. and Sold in Canada by Marine Industries, Ltd., Sorel, Quebec.

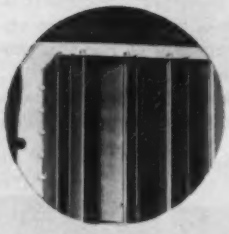
DRAVO

# New AMAZING ONE UNIT COMBINATION GRILLE and VOLUME CONTROLLER

**PURCHASE COST 30% LOWER**

**INSTALLATION COST 50% LESS**





**SOLID SECTION AIRFOIL LOUVER**

STREAMLINED, SMOOTH-AS-GLASS SOLID-SECTION AIRFOIL LOUVER knifes the air in wind tunnel tests. Turbulence has been completely eliminated. The AIRFOIL's clean lines give noiseless control of air at all times.

**DOUBLY FLEXIBLE TWIN BACK LOUVERS**

More flexibility . . . greater and easier air control . . . faster, surer adjustments are certain.

# Air Foil AIR CONDITIONING OUTLETS

Titus steps ahead with the new advance design, compact AF-325 handling both *air volume* and *air distribution*. Designed for installation on exposed duct work in space to be conditioned. Just one unit handles the volume and disburses the air 4 ways. The AF-325 costs less—installs easier.

**ONE COMPLETE UNIT CONTROLS AIR VOLUME AND DISTRIBUTION**

The AF-325 design is simple. An *AIRFOIL volume controller* and *AIRFOIL grille* have been combined. Split rear louvers—all individually adjustable, control volume.

The front set of AIRFOIL louvers control the air distribution handling with perfection the job of draft-free distribution.

**ONE UNIT TO PURCHASE**

Exclusive AIRFOIL design holds cost at a minimum 30% LESS THAN THE COMBINED COSTS OF A VOLUME CONTROLLER AND GRILLE.

**ONE UNIT TO HANDLE AND INSTALL**

Workmen save valuable time in handling one compact unit. One trip up the ladder carries the whole unit and installs it. System can be adjusted in one-tenth the normal time.

The AF-325 has a 1-piece frame, no mullions, a heavy gasket that seals tightly to duct, light but extremely strong construction.

## THE *Air Foil* LINE IS COMPLETE

CHECK TYPE OF GRILLE ON WHICH INFORMATION IS DESIRED

- ☐ Air conditioning outlets
- ☐ Return air grilles
- ☐ Return air registers
- ☐ Volume controllers
- ☐ Ceiling outlets
- ☐ Perforated metal grilles
- ☐ Ornamental grilles
- ☐ Door ventilators
- ☐ Marine diffusers
- ☐ Industrial air distributors
- ☐ Floor registers
- ☐ Automatic back-pressure dampers
- ☐ Grilles for room air conditioners
- ☐ Special made-to-order grilles
- ☐ Installation frames and accessories
- ☐ High velocity factory outlets
- ☐ Toilet exhaust registers
- ☐ Plain lattice grilles
- ☐ Grilles for convector radiators

**TITUS MANUFACTURING CORP.**
**Waterloo, Iowa**

. . . . Please rush me complete information including prices, discounts, and delivery on the amazing, new AIRFOIL Air Conditioning Outlets.

. . . . Please rush me new complete catalog page illustrating AF-325 so that I can add this page to my present Airfoil catalog.

Name . . . . . .

Address . . . . . .

City . . . . . State . . . . . .

RIC-WIL 40th YEAR DEPENDABLE INSULATED PIPING SYSTEMS 1910 • 1950

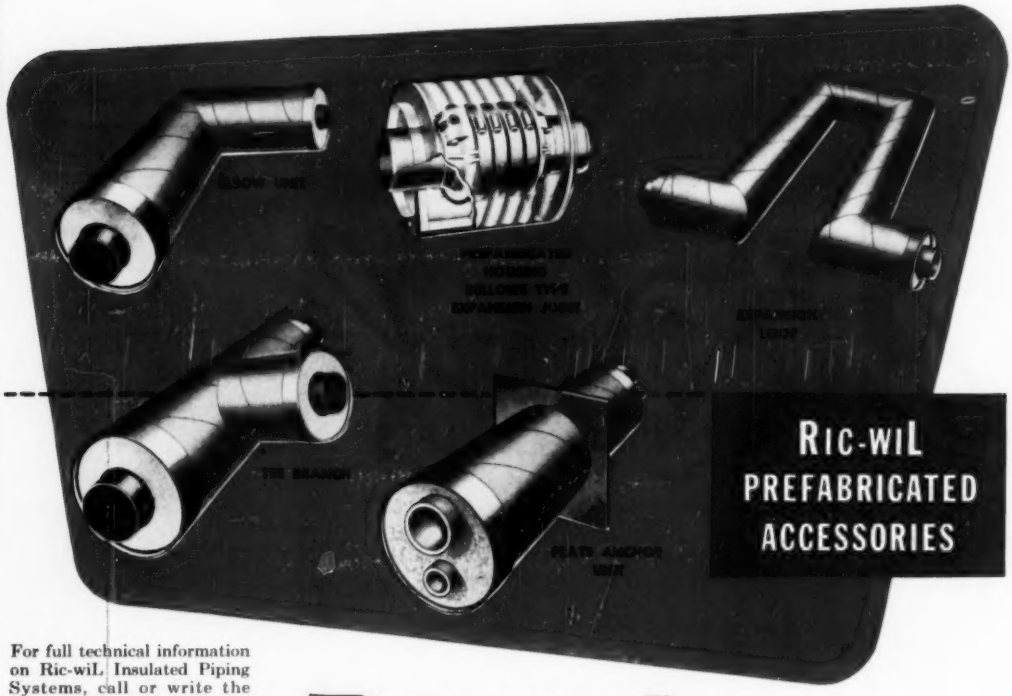
# Now More than ever before you'll want RIC-WIL *Prefabricated* Insulated Piping

Ric-wiL, for forty years the greatest name in insulated piping systems, has kept pace with every known development to produce the world's finest protection and insulation for underground or outside overhead piping systems. Alert and cost-conscious contractors and engineers realize the advantages of Ric-wiL prefabricated 21-foot "straight-run" sections.

Prefabricated accessory units save valuable installation labor costs by eliminating time-consuming makeshift field application of insulation.

The use of the finest known materials, and exacting manufacturing standards give Ric-wiL Insulated Piping Systems "built-in" features for high efficiency performance and extremely long maintenance-free life.

Call the Ric-wiL office nearest you and our representative will be glad to discuss your specific problems at your convenience.



RIC-WIL PREFABRICATED ACCESSORIES

For full technical information on Ric-wiL Insulated Piping Systems, call or write the Ric-wiL office nearest you or Dept. 1-R in Cleveland, Ohio.

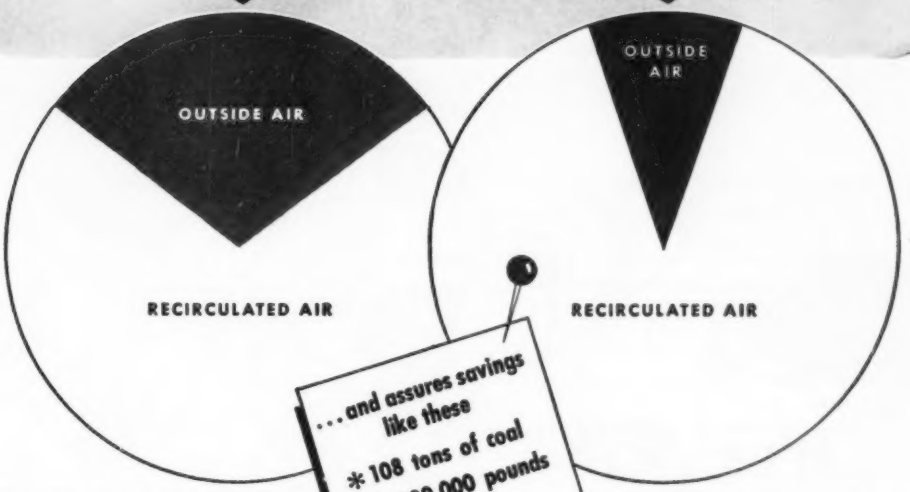
RIC-WIL
INSULATED PIPING SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, O.

OVERHEAD UNDERGROUND

FOR FORTY YEARS THE GREATEST NAME IN INSULATED PIPING SYSTEMS

# DOREX AIR RECOVERY REDUCES OUTSIDE AIR LOAD . . .

**from this . . . to this**




Dorex Activated Carbon Filters installed in an air conditioning system make stale air fresh again. This means air can be reused . . . and the amount of new, outside air that must be taken into the system is reduced by as much as two-thirds.

From this it follows that less heating and cooling capacity is required, making appreciable savings in original costs. Important savings in operating costs result, too—because Dorex Air Recovery completely freshens recirculated air for less than half the cost of conditioning new, outside air.

Cost-conscious business is vitally interested in savings like these. That is why the more than 6,000 Dorex Air Recovery users include many of the biggest names in industry. That is why leading architects, engineers and contractors have been recommending Dorex Air Recovery for the past 20 years.

For full details about Dorex Air Recovery—how it works, who uses it, what advantages it offers you and your clients—mail this coupon today.

DOREX
*Air Recovery*

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*Air Diffusion • Air Purification • Air Recovery*
In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

**W. B. CONNOR ENGINEERING CORP.**
Dept. A-40, 114 East 32nd Street, New York 16, N. Y.

Please send me, without obligation, full information on Dorex Air Recovery.

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City.....Zone....State.....

# Don't Grease that Pump!

## it's a *NEW* GARDNER-DENVER with pre-lubricated bearings

*Gardner-Denver Types B & C Centrifugal Pumps*

Pre-lubricated ball bearings—now furnished with Gardner-Denver types B & C, BE & CE, CAX & CAE Centrifugal Pumps—never need greasing. They're factory lubricated with the proper kind and amount of grease, applied under the cleanest conditions known.

The grease is sealed in—FOR LIFE—all contaminating dirt is sealed out. Lubricant purchasing problems are eliminated. There's never any danger of overgreasing or undergreasing. And you save the time and grease consumed by periodic lubrication.

For lower cost pumping, get full information on Gardner-Denver Centrifugal Pumps with *pre-lubricated bearings. Write us today.*

**GARDNER-DENVER**

*Since 1859*

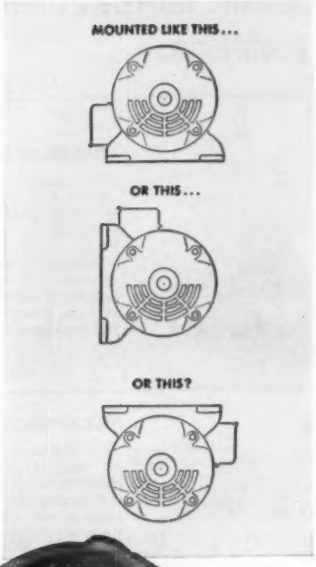
Gardner-Denver Company, Quincy, Illinois

*In Canada:*
Gardner-Denver Company (Canada) Ltd., Toronto, Ontario

YOU CAN BE **SURE**.. IF IT'S
Westinghouse

FOR AIR HANDLING

# Is your motor *really* dripproof?



**. . . AT ANY ANGLE OF MOUNTING—** Do you see a ventilating opening in the frame? Then the motor is probably not dripproof when side wall or ceiling mounted. You need a special motor for these mounting positions . . . with special protection over frame openings. But . . .

You can save the costs of specials with Life-Line motors. Solid frame construction eliminates frame openings. All ventilation is accomplished through the end brackets. Simply rotate the 4-position brackets and the Life-Line is dripproof—for side wall or ceiling mounting.

Dripproof conduit box can be rotated also. Plenty of knockouts give maximum possible connections. And, because a Life-Line motor needs no further lubrication, you can crowd it into cramped quarters . . . mount it in "hard-to-get-at" locations—and forget it. Thus, you get maximum mounting flexibility for difficult mounting problems.

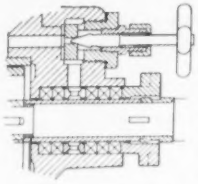
It costs no more to get these "special" features in a standard motor. Simply specify Life-Line as the drive for your equipment. Ask your local Westinghouse representative for details and a copy of booklet B-3842, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21583

***If you figure LIFE-COSTS . . . you'll figure LIFE-LINE***

Westinghouse
*Life-Line*
Motors
INDUSTRY'S LEADING MOTOR

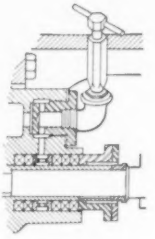
# Are you looking for a pump that's REALLY "HOUSEBROKEN"?

## Here's how Ingersoll-Rand MOTORPUMPS solve your leakage problems.



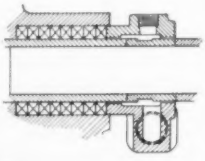
### STUFFING BOX

The conventional stuffing box as furnished on MOTORPUMPS with integral H.P. motors is extra deep and holds 5 or more rings of packing and a seal cage. It is usually used on water or non-volatile liquids at moderate temperature. The standard gland is a split, two-piece type for easy removal from the shaft.



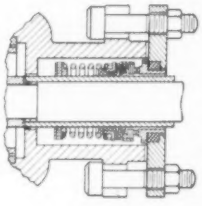
### GREASE SEAL

When handling gasoline or other hydro-carbons, MOTORPUMPS can be equipped with a Merco-Nordstrom lubricator or grease seal. A special compounded stick lubricant is forced into the gland under pressure, effectively sealing and lubricating the packing.



### SMOTHERING GLAND

When handling hot and volatile liquids, a split-type smothering gland is used in place of the standard gland. Water is circulated through the smothering gland and effectively smothers and carries off escaping steam, fumes or liquids which might be objectionable or hazardous.



### MECHANICAL SEAL

Type JCS mechanical seals are standard on MOTORPUMPS with fractional H.P. motors and optional on integral H.P. units. These seals are furnished when conditions call for dripless and tamper-proof stuffing boxes requiring a minimum of maintenance. Lubrication and cooling are effected by the liquid being handled. Drip pans and drain lines are eliminated.

Although leakage is probably the plant engineer's No. 1 pump problem, you'll find that the I-R MOTORPUMPS have been designed to solve the many other maintenance problems with equal effectiveness.

Your nearest I-R representative will be glad to give you the complete story and help you select the MOTORPUMP that's best suited to your particular requirements. Sizes from ¾ to 5" are available for capacities from 5 to 1800 GPM. Shipment can be made promptly from stock.

THE CAMERON

MOTORPUMP

A PRODUCT OF

**Ingersoll-Rand**

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COMPRESSORS · AIR TOOLS · ROCK DRILLS · TURBO BLOWERS · CONDENSERS · CENTRIFUGAL PUMPS · OIL & GAS ENGINES

# IN ALL THE WORLD... NO WRENCH LIKE

## ROXCO

*it's individually* **REGISTERED** *completely* **GUARANTEED!**

**Special MONEY-BACK TRIAL OFFER!**

Buy *one* "Registered" Roxco and use it for your toughest jobs. If you don't agree it stands up better . . . is handier, faster to use . . . is a bigger value than any pipe wrench you've ever used . . . return *that one* trial Roxco direct to us (not the seller), within sixty days with a note of price paid and reason for returning. We will refund your money. This get-acquainted offer good until Dec. 31, 1950. Trimont Mfg. Co., Roxbury, Mass.

**ENGINEERED BY STRESS ANALYSIS TO ASSURE HEAVY DUTY STRENGTH WITHOUT USELESS WEIGHT**

*See dark Hardened area*

Now you need not accept useless, fatiguing weight in order to get a dependably strong wrench. Through stress analysis of every inch, the new Roxco was designed to put *extra* metal *where heavy stresses come.* And, to take out metal where it does *not* count.

The result is not only the handiest pipe wrench a man ever put to work, but also a wrench so strong that it exceeds, by a good margin, Federal Spec's for Heavy Duty Pipe Wrenches, Type II, GGG-W-651a.

So superior is this new wrench . . . so carefully quality-controlled . . . that every Roxco is individually *Registered* by number. And *every* part is *guaranteed* against breakage in any normal heavy duty use! The nine points below show why any wrench buyer and user will want the lighter, easier-to-work-with Roxco to boost efficiency . . . reduce tool costs. Order Roxco, now. Or send for folder and names of distributors.

**1. Extra Strength Based on Stress Analysis:** Extra metal at critical points provides higher resistance to failure. Protects work and worker. Withstands unusual stress in "side pull".

**2. Lighter Weight Achieved:** Stress analysis also showed where useless metal could be eliminated to produce a lighter, handier wrench.

**3. Uniformity of Jaw Hardness and Strength:** Both movable and insert jaws are of drop-forged alloy steel. Teeth are hardened by automatically-timed, localized induction process at wear points, yet the tough core of jaws is retained for strength.

**4. Reinforcing Shoulder Behind Insert Jaw** resists any unusual stress. Assures long, trouble-free service.

**5. Rapid Ratcheting Action:** New, simplified cushion action replaces complicated spring. With Roxco tooth design, it prevents seizure on pipe and permits fast ratcheting action — as fast as user can move his hand. Accurate fit of assembled parts eliminates lost motion — speeds jobs.

**6. Comfort-Shaped, Palm-Fitting Handle:** New wide handle design is more comfortable to use — makes work easier, cuts worker fatigue.

**7. Reinforced Housing** embodies a hammer face to break cast fittings.

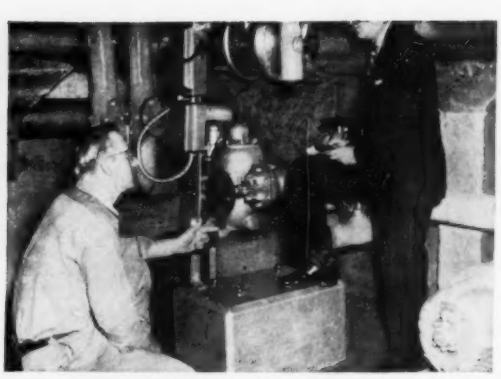
**8. Handy, Accurate Pipe Scale** permits quick adjustment to desired size.

**Special Metallurgical Formula:** Roxco Metal, combined with scientific heat treating, means superior strength in housing and handle.

**TRIMO-ALLOY WRENCH** . . . Roxco's only Rival . . . is an all alloy-steel heavy duty pipe wrench. Different in design, but has power comparable to Roxco.

**TRIMONT MANUFACTURING CO.** Division of Aetna Industrial Corporation, 55 Amory Street, Roxbury 19, Mass. Makers of Wrenches, Pipe Cutters, Vises and Other Trimo Time-Tested Tools.

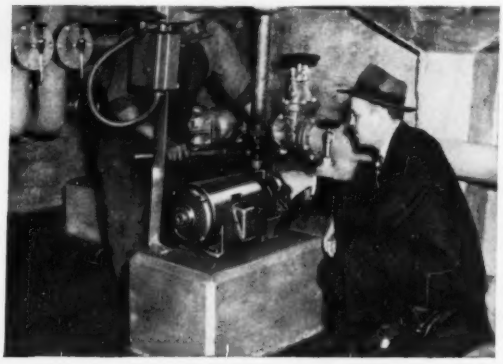
Electrifugal PUMP



ESTIMATING correctly, finding the lowest cost unit that will do the job, involves more than just looking up a price.

PLANNING installation with A-C pump engineer from beginning may save hours of engineering work, eliminate costly errors.

INSTALLING a pump correctly is one of the big secrets of good pump performance. The A-C pump engineer will advise you here, too.



# COMPETENT ENGINEERING HELP...

## *yours with every Electrifugal Pump*

YOU GET MORE than a good pump when you buy an *Electrifugal* pump. You get practical engineering help from a skilled and experienced pump engineer. He will sit down with you in the planning stage, offering his advice and know-how to help you design a better system at lowest cost. He will carry the job all the way through, even to showing you the quickest, easiest way to install a pump correctly. Often he can save you many dollars by suggesting a change in piping, valving or other arrangement.

Allis-Chalmers pump engineers are trained to understand the problems of the air conditioning industry. They can save you much costly engineering work and *guarantee* a satisfactory job.

Remember, too, Allis-Chalmers can supply pumps, motors, *Texrope* V-belt drives and motor control for immediate delivery from field stocks. Fast service. No waiting.

You can make money by relying on Allis-Chalmers pump engineers. You can get in touch with one by calling your Allis-Chalmers Authorized Dealer or Sales Office. And be sure your "sources-of-equipment" file contains a copy of A-C Bulletin 52B6059. Write today. A-2987

ALLIS-CHALMERS, 1171A SO. 70 ST.
MILWAUKEE, WIS.

***Sold . . .***
***Applied . . .***
***Serviced . . .***

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

**MOTORS** — ½ to 25,000 hp and up. All types.

**CONTROL** — Manual, magnetic and combination starters; push button stations and components for complete control systems.

**TEXROPE** — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

*Electrifugal* and *Texrope* are Allis-Chalmers trademarks.

A-C ALLIS-CHALMERS

# ALLIS-CHALMERS

# Big Reason For Cheap Electricity!

## "Buffalo" Induced Draft Fan – –

—one of six being built for prominent power company. 16′2″ high, it has a rated capacity of 202,500 cubic feet a minute against 15″ static pressure. In service, a continual storm of fly ash will pass through this fan. That's why "Buffalo" Builds Induced Draft Fans ruggedly—to stand power plant service the maximum time without repairs or shutdowns. And that means lower power costs! Note "Buffalo" Paraflow Dampers on inlets and outlets for accurate draft control.

## Big Wheel in the Power Industry!

At right, the 12½ ft. wheel for the fan shown above. Note heavy plate construction with welded-on wearing strips on blades. The wheel takes the beating in draft work—that's why "Buffalo" wheels are TOUGH!

***Write for Facts:*** Dependable draft is a fundamental way to keep power costs down. Pick "Buffalo" Forced and Induced Draft Fans and be sure! Write for Bulletins 3113-A and 3190-B for all the facts.

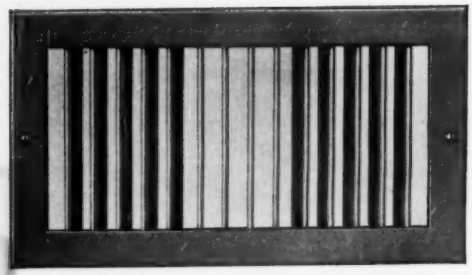
## BUFFALO FORGE COMPANY

**171 Mortimer St.** **Buffalo, New York**

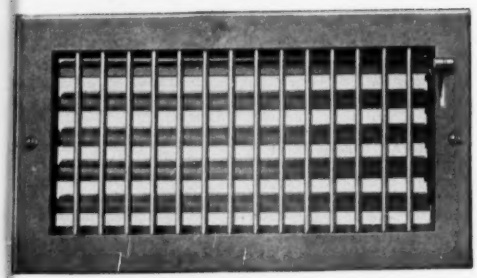
**Canadian Blower & Forge Co., Ltd., Kitchener, Ont.**

***Branch Offices in All Principal Cities***

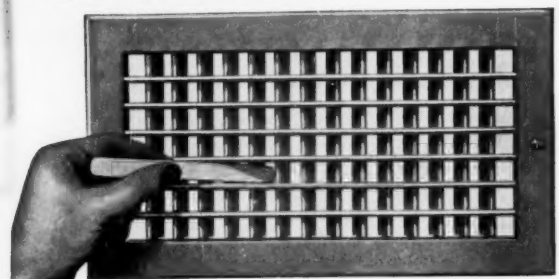
# When You Compare Registers and Grilles for High Velocity Systems — You'll Choose AUER "Streamliners"



No. 1005V.
Single bank of adjustable bars, no valve.



No. 1005V-HML.
Single bank of adjustable bars, with multi-louvre valve.



No. 1205HV.
Double bank of adjustable bars, no valve.

**Grilles with single or double banks of adjustable bars, also single or double face registers with multi-louvre volume control, are now made by several manufacturers. We believe most of these products for high velocity systems of air conditioning, ventilating, or cooling, to have merit. However, we believe Auer "Streamliners" are in a class by themselves, for these reasons:**

**1.** The hollow moulded bars, smooth in contour, are pivoted in the frame on unique split sleeves, or expansion inserts, effective for the life of the register. These furnish just enough tension to hold bars firmly where set, yet allow sufficient play to adjust accurately with one simple tool.

**2.** Each bar is pivoted in its exact center, and shaped somewhat similar to an airplane wing, so that for either return or supply, each bar can be completely turned around. For outlets, some users turn the thin edge to the front, and the broader edge toward the flow of air, thus using a basic theory of aerodynamics, and reducing resistance and turbulence to a minimum.

**3.** Blades of multi-louvre volume control are pivoted on tension rivets to guard against vibration or noise, another important feature.

**4.** There is nothing, so far as we know, to wear out, pull loose, or give way in service, in a Streamliner.

Air conditioning and cooling experts know that these intakes and outlets call for specialized design and manufacturing ability. Auer is a pioneer in high grade air conditioning and cooling work. Compare the engineering merits of *all* registers for high velocity outlets. Then you will appreciate the superiority of Streamliners.

**8 MODELS.** The Series includes models with single bank of adjustable bars (vertical or horizontal), also with double bank of adjustable bars (vertical in front and horizontal in back, or the reverse), also all above four types with the addition of horizontal multi-louvre valves in the rear, controlled by lever on face of register.

*Ask for Bulletin S-49. For forced air or gravity registers, we will send you complete Auer Register Book—for perforated grilles, Catalog "G".*

**THE AUER REGISTER CO., 3608 PAYNE AVENUE, CLEVELAND 14, OHIO**
CANADIAN DISTRIBUTOR, MARCHAND FURNACE, LTD., TILBURY, ONT.

**Auer REGISTERS & GRILLES for AIR CONDITIONING & GRAVITY**

# WHY fireye

There's only one reason for putting a Flame Failure Safeguard on an oil or gas burner . . . to prevent an explosion . . . to safeguard your entire plant, equipment, and personnel.

Fireye insures complete flame failure protection because it is photoelectric . . . it sees the flame . . . and if the flame fails, Fireye acts with the speed of light to cut off the fuel *before* dangerous gases accumulate in the combustion chamber.

Controls which do not react instantaneously can not provide full protection . . . for it is the few seconds of delay between flame failure and fuel shutoff which charge the combustion chamber with potential destruction.

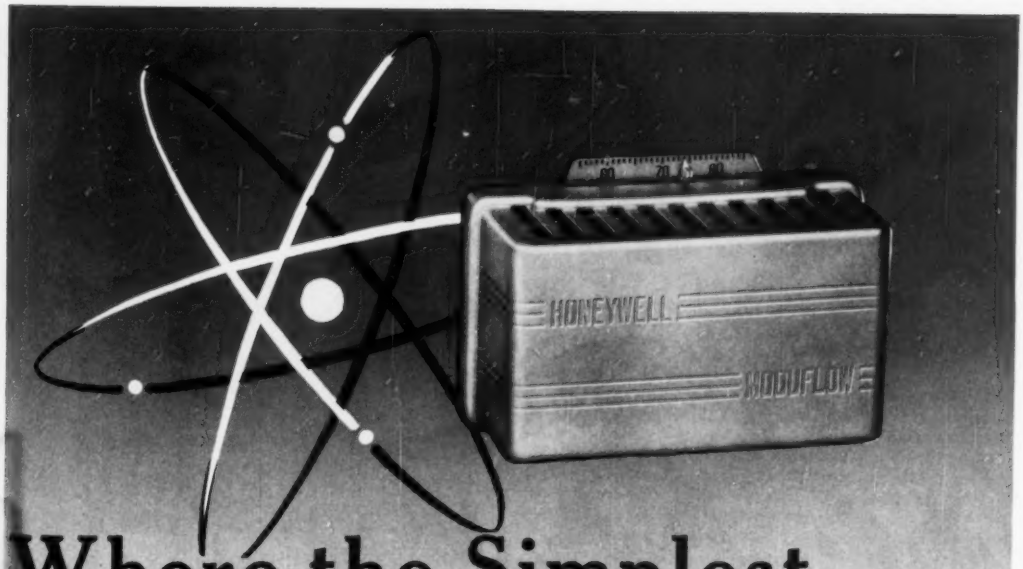
Fireye is the outstanding combustion safeguard which meets the exacting requirements of insurance laboratories for the protection of ALL classifications of oil and gas burner installations.

Write for bulletin 604-B

fireye

COMBUSTION CONTROL CORP.

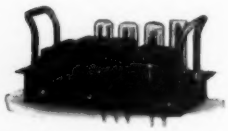
77 BROADWAY, CAMBRIDGE 42, MASS.



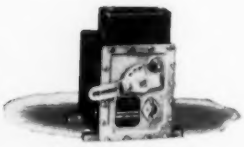

# Where the Simplest is also the Best Honeywell Electronic Control

## for Heating, Ventilating and Air Conditioning

Duct and immersion thermostat



Electronic relay



Modulating motor

HERE is everything you've wanted in an air conditioning, heating or ventilating control system — FASTER ACTION, MORE SENSITIVITY, GREATER ACCURACY, WIDE VERSATILITY, and ABSOLUTE SIMPLICITY.

Honeywell Electronic Control can sense and correct for a room temperature change almost before it happens! The speed of correction is limited only by the mechanical limitations of the air conditioning equipment. Temperatures are maintained within a fraction of a degree, with no overshooting, no waste of heating or cooling.

Yet, Honeywell Electronic Control is amazingly simple. One thermostat — with no moving parts — can control both heating and cooling. The system has less to wear out, less to get out of adjustment. Get all the details now. Phone the Honeywell office in your city or address a card to Minneapolis-Honeywell, Minneapolis 8, Minnesota. In Canada: Leaside, Toronto 17, Ontario.

MINNEAPOLIS
**Honeywell**
FIRST IN CONTROLS

77 BRANCHES FROM COAST TO COAST WITH SUBSIDIARY COMPANIES IN: TORONTO • LONDON • STOCKHOLM • AMSTERDAM • BRUSSELS • ZURICH • MEXICO CITY

Cafeteria: Home Insurance Company, New York, N. Y. • Architect: T. H. Engelhardt
Engineer-Contractor: Buensod-Stacey, New York, N. Y.

A PROBLEM
IN
*Beauty and Balance*

## ...solved by **kno-draft** adjustable air diffusers

The air-conditioning problem in this company cafeteria was to select air diffusers that would "go" with its rich design and, at the same time, balance the great heat differential between the serving and the dining area.

Kno-Draft *Adjustable* Air Diffusers solved both problems.

Notice how well Kno-Draft's clean, concise lines harmonize with paneling and chandeliers. Take a satisfied user's word for it that the pattern of air flow provides equalized temperature and thorough distribution—*without draft*—throughout the entire area.

With Kno-Draft *Adjustable* Air Diffusers, both air volume and direction are completely and easily controlled *after* installation. A screw driver is the only tool needed. Kno-Draft Air Diffusers are as much "at home" in modern as in traditional surroundings . . . and there are types and sizes to meet every requirement.

**KNO-DRAFT DATA BOOK:** Complete specifications, engineering and installation data on Kno-Draft *Adjustable* Air Diffusers. To get your copy, simply fill in and mail the coupon. No obligation, of course.

W. B. CONNOR ENGINEERING CORP.
114 East 32nd Street, New York 16, N. Y.
*Air Diffusion • Air Purification • Air Recovery*
In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

**W. B. CONNOR ENGINEERING CORP.**
**Dept. G-40, 114 East 32nd Street, New York 16, N. Y.**

Please send me, without obligation, my copy of the Kno-Draft Air Diffuser Data Book.

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Position.....
Company.....
Street.....
City.....Zone....State.....

Let this entire page represent the area of plain tube required for your heat transfer. The same heat transfer surface can be concentrated in relatively the space occupied by this block of type by using Wolverine *Trufin—the integral finned tube.

*Send for literature*

**WOLVERINE TUBE DIVISION**
CALUMET & HECLA CONSOLIDATED COPPER COMPANY
Manufacturers of seamless, non-ferrous tubing
1419 CENTRAL AVENUE • DETROIT 9, MICH.
Plants in Detroit, Mich. and Decatur, Ala.
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## Engineers, contractors, users

*Demand this Assurance*

OWENS-CORNING
FIBERGLAS
COATED DUCT INSULATION
OWENS-CORNING FIBERGLAS CORPORATION • TOLEDO 1, OHIO
Underwriters' Laboratories, Inc.
INSPECTED
BUILDING MATERIAL
FIRE HAZARD CLASSIFICATION
(Based on 100 for untreated red oak)
FIRE SPREAD . . . . . 10 - 20
FUEL CONTRIBUTED . . . 10 - 15
SMOKE DEVELOPED . . Negligible

## Fiberglas* Coated Duct Insulation has it!

Listing by the Underwriters' Laboratories, Inc. is another *first* for Fiberglas Coated Duct Insulation. Based on their tests it is now universally accepted by insurance interests as a *fire retardant* material . . . also *no* panic hazard, no toxic fumes because smoke developed is negligible.

To users of Fiberglas Duct Insulation, especially in concealed spaces, this means *impartial* assurance of greater property fire protection . . . more lasting protection because of the natural properties of the basic material, spatter fibers of glass.

Get complete information and data about on Fiberglas Duct Insulation by phoning the local Fiberglas Sales Office in leading cities. Or write to OWENS-CORNING FIBERGLAS CORPORATION, Dept. 40-D, Toledo 1, Ohio.

OWENS-CORNING
FIBERGLAS
THERMAL INSULATING MATERIALS

*Fiberglas is the trade mark (Reg. U. S. Pat. Off.) for a material consisting made of or with glass fibers by Owens-Corning Fiberglas Corporation.

FIBERGLAS IS IN YOUR LIFE . . . FOR GOOD!

POWERS
# FLOWRITE
VALVE

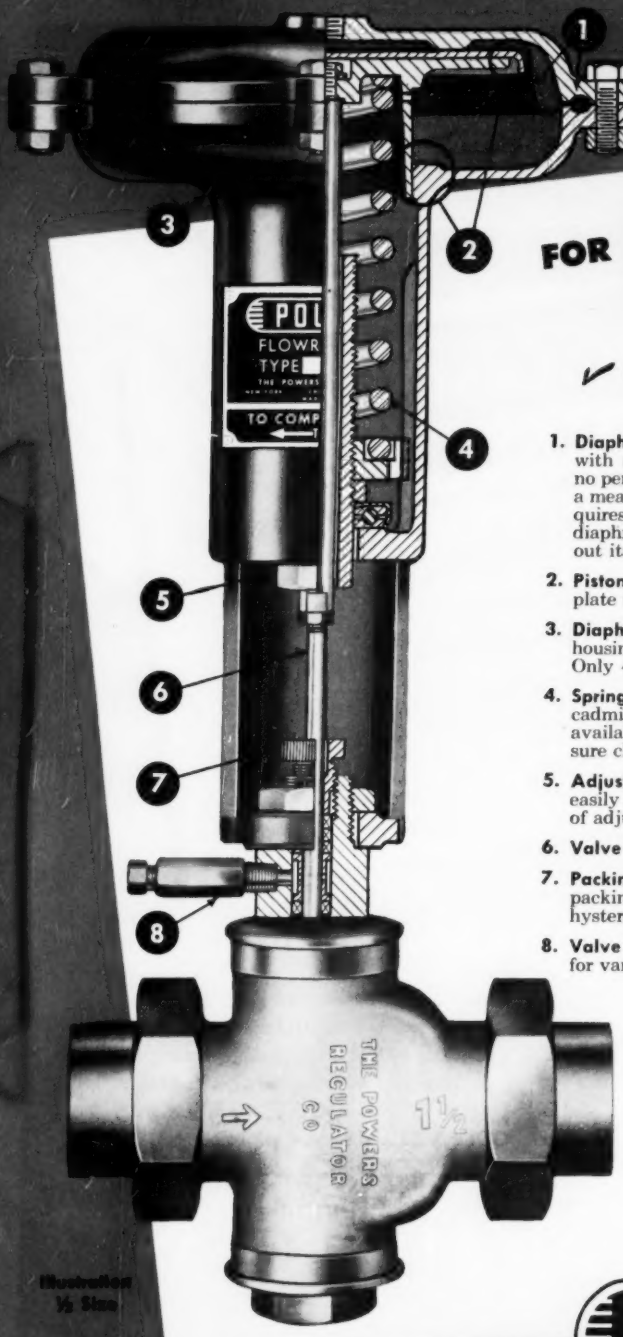



Illustration ½ Size

## FOR BETTER CONTROL

### ✓ Check these Features of *NEW* POWERSTROKE TOP!

1. **Diaphragm**—Long life moulded Neoprene diaphragm with specially designed leak-proof sealing ring. Has no perforations or bolt holes. Diaphragm ring supplies a means for self-sealing under increasing pressure. Requires minimum of force for compression. Shape of diaphragm provides a constant effective area throughout its travel.
2. **Piston Plate**—Accurately guided self-aligning piston plate to eliminate side thrust.
3. **Diaphragm Housing**—Special high quality cast iron housing and top for ruggedness and corrosion resistance. Only 4 bolts are used to permit easy removal of top.
4. **Spring**—Enclosed special alloy steel calibrated spring, cadmium plated to prevent corrosion. Two spring rates available to give full valve travel in 5 or 10 lbs. pressure change in top.
5. **Adjusting Screw**—Ball bearing, non-rising type. Is easily accessible. Has 180° turning radius—wide range of adjustment.
6. **Valve Stem**—Polished stainless steel.
7. **Packing Gland**—Easily accessible, specially formed packing with metallic jacket for long life and low hysteresis.
8. **Valve Stem Lubricator**—Ball check type—lubricants for various conditions.

**VALVES—Sizes:** ½" thru 8". For line pressures up to 250 lbs. per square inch. Rugged construction to withstand piping strains.

### VARIETY OF VALVE BODIES

Single seat or double seat, bronze and stainless steel trim. Double unions and flanged ends. Available normally open (direct acting) or normally closed (reverse acting) and 3-way mixing type valves.

# POWERS

OVER 55 YEARS OF PNEUMATIC TEMPERATURE CONTROL—OFFICES IN OVER 50 CITIES

**Complete Line of Controls for Heating and Air Conditioning Systems,**

# AND EXTRA YEARS OF DEPENDABLE SERVICE

POWERS

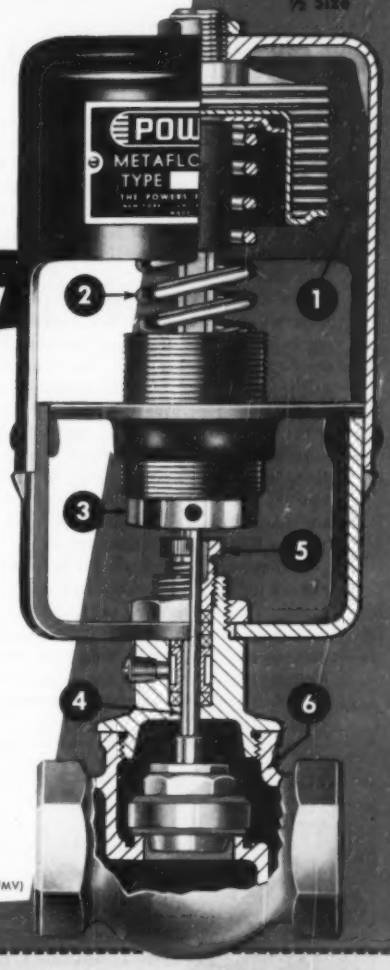
# F and M AIR OPERATED CONTROL VALVES!

The Powers Regulator Co., pioneer in the development of the first all-pneumatic system of temperature control, now offers a new line of modern valves.

Check their many valuable features which can help you make important savings. Test and compare their superior performance with other valves. You'll find POWERS' valves moderately priced—often give more reliable operation over longer periods of time.

Contact our nearest office for further information or mail coupon below. THE POWERS REGULATOR CO., 2720 Greenview Avenue, Chicago 14, Ill. Offices in over 50 cities. Established in 1891.

Illustration ½ Size




Powers *Metaflow* Valves are small, sturdy, lightweight, reasonably priced, suitable for many control applications where space is limited and the pressure differential does not exceed 75 lbs. per square inch.

POWERS METAFLOW VALVE

## SPECIFICATIONS

**1. Housing and Bellows**—Two sizes, 5" and 8" with specially formed brass bellows.

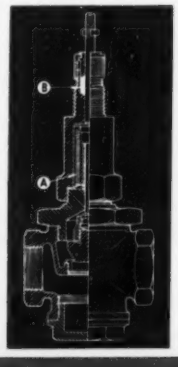
**2. Spring**—Cadmium plated. Calibrated to give full valve travel with 5 lbs. air pressure change.

**3. Adjusting Screw**—Brass, easily accessible. Has 15 lbs. adjustment range to give proper sequence operation where required.

**4. Stem**—Polished stainless steel.

**5. Packing Gland**—Specially formed packing with metallic jacket, grease sealed for long life and low hysteresis. Stem lubricator and variety of lubricants available as optional feature.

**6. VALVES—Sizes:** ½" thru 2"; bronze bodies with screwed ends, maximum body pressure 125 lbs., rugged construction to withstand piping strains. **TRIM**—Composition disc with brass integral seat and self-aligning disc holder. Available normally open (direct acting) or normally closed (reverse acting), and three way.




## METAFLOW PACKLESS VALVES

Prevent leakage of dangerous inflammable or harmful liquids or gases . . . . prevent waste and provide vacuum protection. Are suitable for use with Freon, oil, gasoline, non-corrosive gases, hot or cold water and low pressure steam. Have many uses in chemical plants, oil refineries, power plants, submarines and surface vessels.

**Specifications:** Direct acting valves (normally open); 125 lb. brass bodies, sizes ½", ¾", 1", 1¼"; stainless steel seats and poppets; stem seal (A) is made of specially formed flexible brass bellows. Auxiliary packing gland (B) provides additional safeguard.

***Water Heaters, and Industrial Processes***

THE POWERS REGULATOR CO., 2789 Greenview, Chicago 14, Ill.
Send futher information and prices on POWERS
☐ FLOWRITE VALVE ☐ METAFLOW VALVE ☐ Packless Type
☐ Control Instrument for _____ (Process or Operation)
Name _____ Title _____
Address _____
City _____ State _____

# AMERICAN-Standard

**First in heating . . . first in plumbing**

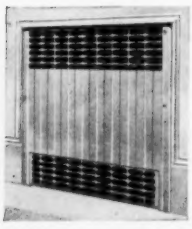
# The Arcoliner Wet Base Boiler

## *specially designed to meet the needs of small homes*

THIS compact, cast iron oil fired boiler with its unique wet base construction has been scientifically engineered to handle a specific heating problem—to offer economical, efficient and safe heating in small homes and individual apartments where first floor installation of heating equipment is necessary. Of course, it's excellent for basement installation too.

The Arcoliner's wet base construction means that waterways extend *below* combustion space, providing extra heating area, and preventing the floor beneath from overheating—thus assuring safety for utility room, closet or kitchen installation. Correctly proportioned sections and effective heating surfaces are of durable cast iron for quick heat pick-up and longer life. Multi-finned flues insure maximum heat absorption. Machine-ground joints keep air out and heat in. Extra large nipples extend below water line and assure balanced internal circulation, also permit use of a Biltin Taco Water Heater.

The Arcoliner is available as a complete boiler-burner unit with the Arcoflame Oil Burner, or separately for use with any other good oil burner. The Arcoliner or other boilers in the American-Standard line are sold through Wholesale Distributors to Heating and Plumbing Contractors. **American Radiator & Standard Sanitary Corporation,** P. O. Box 1226, Pittsburgh 30, Pennsylvania.



**The SUNRAD Radiator**

Made of durable cast iron, the **SUNRAD** provides both radiant and convected heat. Its smart, simple lines blend nicely with any decorative scheme, making it an ideal unit for all types of residential or commercial buildings. Can be installed recessed, semi-recessed or free-standing.

*Look for this Mark of Merit*

*Serving home and industry*

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

# *Thrush* HORIZONTAL CIRCULATOR

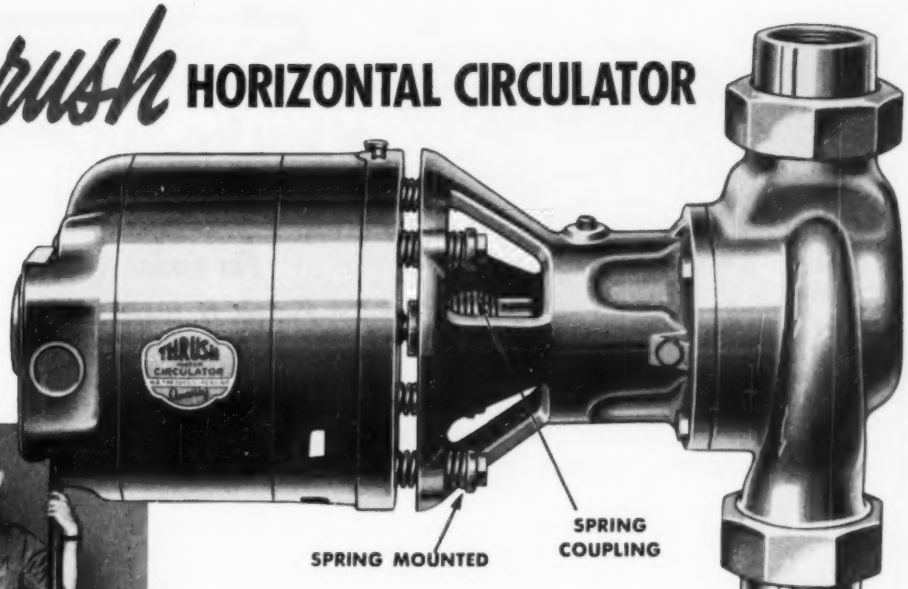


Illustration shows great strength of spring mounting which holds motor in perfect alignment always.

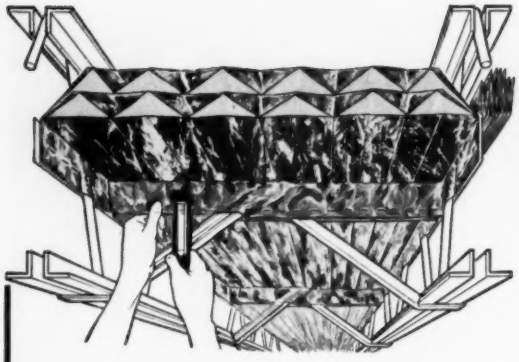
## PERMANENT *Alignment!*

## QUIET FOR A LIFETIME

THE THRUSH Horizontal Water Circulator is sturdily built, to operate efficiently and quietly throughout its life. Tempered steel spring mounting of motor to Circulator frame and patented spring coupling connection of motor and pump shafts, assure permanent alignment with smooth, vibration-free performance. The unique spring suspension never loses its resilience or sags, as no rubber is used. Sealed-in lubrication with positive oil flow over all moving surfaces, means freedom from wear and service troubles. Thrush pioneered Forced Circulating Hot Water Heat for homes, and this new Horizontal Type Circulator is the culmination of nearly a quarter century of experience in circulator building. Specify Thrush controls for real satisfaction.

ASK YOUR WHOLESALER ABOUT THRUSH EQUIPMENT
OR WRITE DEPARTMENT E-4.

**H. A. THRUSH & COMPANY • Peru, Indiana**



# Steel truss problems of heat loss, heat intrusion and condensation solved

***For under 15c sq. ft. material plus labor***

**IN FACTORIES, WAREHOUSES, HOSPITALS, SCHOOLS, MARKETS, ARENAS, THEATRES, FIREPROOF RESIDENCES, ETC.**

It is hard to keep these structures comfortably warm or cool. In addition, condensation forms, often drips, causes damage. These problems are solved by using 3, tough, never-touching sheets of aluminum, compartmented by 2 fiber or asbestos partitions.

Steel beams are good conductors, exchange much heat with the surrounding atmosphere, causing condensation, and need insulation against heat and vapor flow. Multiple accordion aluminum sheets allow no vapor to pass; are non-condensation-forming; retain no moisture. With their zero permeability, they push out fortuitous vapor from wall, floor, and ceiling spaces. They emit practically no heat on the cold side—only 3%.

Contrast this with the necessity of heating-up tons of steel and mass insulation (usually wet) which wastefully emit 90% heat on the cold side. In summer, iron, steel, mass insulations, and most building materials, continue to radiate uncomfortable heat into a room long after the outside air has cooled. Multiple accordion aluminum sheets not only are cool at night, but all through the hot summer day often maintain temperatures 10° to 20° cooler than the shade outside.

Insulation as described above is technically called Type 6 Infra.

**THERMAL FACTORS, TYPE 6 INFRA**

**Down-Heat C.044, R22.72 equals 7½" DRY Rockwool**
**Up-Heat C.080, R12.50 equals 4" DRY Rockwool**
**Wall-Heat C.073, R13.69 equals 4½" DRY Rockwool**

**VAPOR PERMEABILITY equals ZERO**

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# THE EDITOR'S PAGES

## INDUSTRIAL USES OF A.C. TO EXPAND

THE AIR conditioning industry should continue its steady growth during the 1950's, according to Reuben N. Trane, president of the Trane Co.; in announcing record Trane sales ($24,222,876) in 1949, Mr. Trane emphasized continued expansion of research and development activities that will establish important growing markets for air handling, cooling and heating equipment in the next few years.

During the past two decades—most important in air conditioning's growth—popular interest has centered on comfort air conditioning. Installations in numerous buildings completed since the war have demonstrated the economic value of conditioned air in increasing plant and office productivity and reducing personnel turnover, as well as boosting sales in retail stores, restaurants and other business places. Competition during the 50's will lead thousands of owners of older buildings to incorporate some form of comfort air conditioning in their plans for remodeling and modernizing their facilities.

Even more spectacular than the growth of comfort air conditioning during the next decade will be the expansion of industrial, food and chemical processing, and transportation uses, Mr. Trane predicted. Among the interesting developments are:

Dry blast systems for reducing moisture content in the air used in producing pig iron and steel and making steel and nonferrous castings. These systems can cut coke consumption, increase blast furnace productivity, and assure more uniform production of carbon steel, special alloys and various metal products.

"Cheap oxygen" production. Another development leading to greater steel production at lower cost, in which exceptionally low temperatures must be produced.

Air conditioned trucks and freight cars that will ship a wide variety of fresh and frozen foods to market under precisely-controlled temperature and humidity, thus reducing spoilage, preserving nutritional content, and offering the public greater menu variety throughout the year.

Improved methods and equipment for chilling, heating, and temperature and moisture control in such varied industries as baking, brewing, confections, ceramics, distilling, electrical manufacturing, metalworking, pharmaceuticals, plastics, printing, textiles and tobacco.

The need for new air conditioning, heating and refrigerating methods in industrial processes generally increases when competition and pressure for cost-cutting is greatest, Mr. Trane said.

### "QUOTE"

"Safety in the plant, is, of course, obviously a humanitarian consideration. I don't believe there is a plant owner in the nation who has not a sincere interest in the safety of his workers. No one wants a worker to be killed or injured. But, added to this, is the fact that a safe plant is a productive plant. Safe working conditions mean more productive capacity, less costs, more profits. In short, safety in the plant is essentially good business.

"No one, be he a management representative or a worker, has any quarrel with safety. Everybody is for it. No one is against it. And here is a particularly fertile field for management and labor to join forces and work out the problem together. I believe that effective labor-management cooperation for safety will do a big part of the job in obtaining marked accident reductions. I also believe that both management and labor can derive valuable benefits by working together cooperatively in this field of general agreement."—WILLIAM B. BARTON, employer-employee relations director of the Chamber of Commerce of the United States, at the Minnesota Governor's Conference on Industrial Safety.

## BUILDING CONTRACTS SHOW BIG GAINS

CONTRACTS awarded for building and heavy engineering works in the 37 states east of the Rocky Mountains in February totaled $779,530,000, showing an increase of 7 percent over January 1950, and a 37 percent rise over February 1949, according to F. W. Dodge Corp. All classifications, residential, nonresidential and heavy construction were greater in February than in January. Only heavy construction fell behind in February compared with the corresponding month in 1949.

The two months construction total for this year was $1,510,385,000, an increase of 44 percent over the total for January and February 1949.

Residential projects amounted to $361,452,000 in February, of which $342,341,000 was private building and $19,111,000 public building. Apartment buildings represented $75,138,000 of this. February residential contract awards were 5 percent above January 1950, and 87 percent better than February 1949.

Respective gains of 13 and 20 percent were noted in the nonresidential field in February over the first month of this year and the February 1949 total. Leading February's nonresidential projects were hospital buildings for a total amount of $66,949,000. Hospital projects were 141 percent ahead of January 1950 and 112 percent more than in February last year. Other public and institutional contract awards were also up compared with February 1949.

## OIL HEATING INDUSTRY EXPECTS FURTHER GAINS

ENCOURAGED by the sale of 570,593 oil burners for central heating in 1949—an increase of 25.4 percent over the total for 1948—manufacturers have set their sights on a further increase in production in 1950, according to the Plumbing and Heating Industries Bureau.

The year 1949 was the second best in the oil heating industry, was topped only by the record high of 888,083 installations in 1947.

# THE EDITOR'S PAGES

## INVESTIGATE NOISE IN PIPING SYSTEMS

A FUNDAMENTAL investigation of the noise in fluid piping systems at Armour Research Foundation, Chicago, originally sponsored by the Office of Naval Research, is now supported by the Bureau of Ships. This project has led to the discovery of important basic phenomena in the propagation of noise through piping systems, a branch of science which has previously received little or no attention.

A system of measurement has been developed which accurately measures the performance of a piping component in terms of a coupling coefficient and a dissipation factor. Study of these parameters required a new basic theory, new instrumentation, and new techniques of measurement.

The research is being directed toward means of reducing noise in piping systems. This includes introducing sound absorption in the piping and reducing coupling between piping components such as couplings, hangers, etc.

## REMOTE CONTROL DEVICES IN ATOMIC ENERGY PLANTS

DEVELOPMENT OF devices for the remote control and operation of hazardous processes in U.S. atomic energy installations has been largely responsible for the excellent safety records of such plants, according to Robert S. Neblett, of the General Electric Co. He is business and construction manager of the Knolls atomic power laboratory, which G.E. operates for the Atomic Energy Commission.

Speaking recently in Washington, before the machine design division of the American Society of Mechanical Engineers, Mr. Neblett stated that atomic energy work in this country has been done on the basis that the dignity of the individual is important. "If we can't make it safe, we won't do it," has been the policy, he declared.

Everything connected with the preparation of fissionable material as we know it today, and with the production of power from such material, as we now envision it, must be done remotely, he said. In some cases, he added, complicated assemblies of pipes, 20 to 30 ft long, are removed without requiring a human being to come close to them. Because it is radioactive, the pipe is buried and a new section inserted, all remotely.

"Most of this work could be done at less cost in dollars by sending in crews of men, but the cost in lives would have been enormous," said Mr. Neblett. "Through mechanical engineering we have been able to accomplish not only unique operating designs but safe maintenance procedures as well." Though it is something like "trying to do a job with one hand tied behind one's back," he added, "we can now do these maintenance jobs by remote control almost as quickly as they would be done in a normal plant."

He cited some of the problems that pose a tremendous challenge to the mechanical engineering profession in creating a successful atomic energy industry, particularly in the power field.

"We must learn how to handle liquid metals at high temperature," he declared. "We must solve the problem of heat transfer rates which at the present time seem out of this world. We must not only learn how to build these atomic power plants at an economical figure, but we must learn how to operate them economically and to maintain them over long periods.

"The stress analysis work, the heat transfer work, the plain mechanical ingenuity required to pump liquid metals, to say nothing of the problems of how material behaves under intense radioactivity, are all major mechanical engineering problems. However," said Mr. Neblett, "those of us in the atomic energy business feel sure that these problems will be solved, but we know that it is not an easy job, and that atomic power is certainly not just around the corner."

## PERHAPS WE SHOULDN'T MENTION IT . . . . . .

WE'VE NEVER been one to decry the Englishman's sense of humor—too many books by Englishmen, and too many stories we've heard Englishmen tell, are evidence enough for us that the English *do* have a sense of humor (and a very good one).

We wonder, however, if a certain group of Englishmen (the ones that write advertisements for some of the magazines from across the Atlantic) aren't selling the English sense of humor a little short.

We'll present the facts, and leave it up to you. In the advertisements in one issue of one of the British magazines, we noted the following:

"Steel pipe, but buy ————'s fittings." (Get it?)

"Hot under the scholar." (Caption for a picture showing a schoolboy sitting on a radiator in an ad about the heating of a new school.)

"Famous British junctions," a headline on an ad showing a picture of the London airport and explaining how ————'s pipe fittings make "reliable, leakproof junctions requiring the minimum of maintenance."

Of course, the one about the sealing compound could happen anywhere; it shows a seal (the animal, you know) dressed in overalls and a derby, pipe wrench sticking out of a pocket, and captioned "the seal that does the job."

Our next example is an ad showing a big photo of a pipe organ. It points out that harmonious tuning of the organ depends upon the accuracy of the pipes, and that where pipes are used for distributing water or gas instead of diffusing melody, careful fitting is necessary for best results.

Our last example, one entitled "murmuration of starlings," has a glowing first paragraph about our feathered friends and how they "mount as with one heart and will and purpose." It then swings into the advertiser's far-flung organization, and points out in conclusion that starlings have their place in the economy of nature, while ————'s products have their place in the efficiency and productivity of industry.

We're not mad at anyone about all this, and we're not trying to start a reform movement. We just want to mention it.

For Pressures up to 1500 Ft.

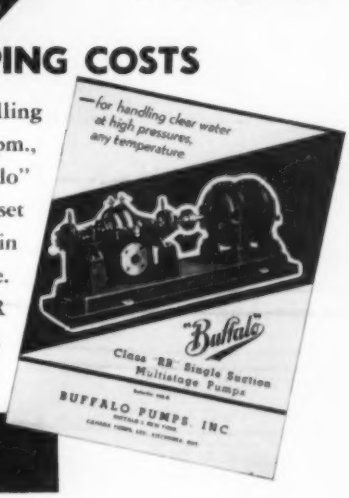
For Clear Water Service

Efficient at any Temperature

"Buffalo"
"RR"
PUMPS

## READY TO CUT YOUR PUMPING COSTS

If you have a clear-water pumping application calling for a high head and capacity between 20 to 900 gpm., you'll get satisfaction with an "RR". These "Buffalo" Single Suction Two and Four Stage Pumps have set both efficiency and endurance records on the job — in air conditioning, boiler feed and other general service. Thousands in use all over the country. WRITE FOR BULLETIN 980-B for the facts on these pumps users say you can "put in and forget".


—for handling clear water at high pressures, any temperature
"Buffalo"
Class RR Single Suction Multistage Pumps
BUFFALO PUMPS, INC.

**BUFFALO PUMPS, INC.**

171 MORTIMER ST. BUFFALO, N. Y.

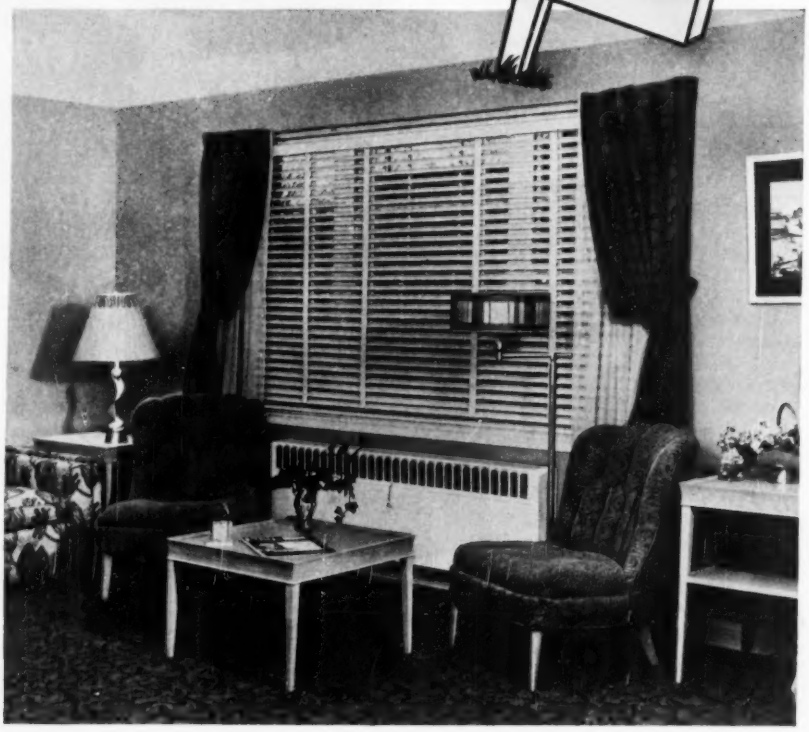
Canada Pumps Ltd., Kitchener, Ont.

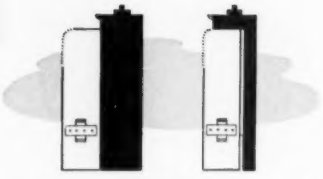
Branch Offices in all Principal Cities

# 10,264 NESBITT CONVECTORS in this new apartment project...

*Lynnewood Gardens, on the outskirts of Philadelphia, embraces 126 acres. When completed, its 127 Colonial type buildings will contain 1,798 apartment units.*

**ARCHITECT:** James Ludwig
**BUILDERS:** Orleans Cons. Co.
Tyson Construction Co.
**HEATING:** Plumbing & Heating Service Co.





FREE STANDING **ONE CABINET** SEMI-RECESSED

Made in 21 stock sizes: Heights, 20" and 24". Lengths, 16" to 64". Capacities, 14.5 to 71 e.d.r. In floor and wall-hung types.

Every heating contractor can profit by the experience of the builders of Lynnewood Gardens—who did not choose just "any" convectors for their 1,798-unit apartment project, but after critical comparison of several good makes chose NESBITT MODEL U CONVECTORS. Quality, design, construction, finish, and the universal features which save manhours of installation time SOLD them. Owners and tenants are SOLD by the same worthy advantages. When you need COMFORT you need CONVECTORS. And whether it's one convector or a carload, you save time and money and service calls—with NESBITTS.

**NESBITT CONVECTORS**

*SOLD EXCLUSIVELY THROUGH PLUMBING AND HEATING WHOLESALERS*

**A product of JOHN J. NESBITT, INC., State Road and Rhawn Street, Philadelphia 36, Pa.**

DO YOU HAVE something to say about any of the articles published this month? An additional comment, or perhaps a question on some point? Or do you want to contribute your views on some other matter of interest to heating, piping, and air conditioning engineers or contractors? We follow here the custom at engineering society meetings of allowing a period for discussion following presentation of a paper. You are invited to contribute your comments. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

## AUTOMOBILE EXHAUST A SOURCE OF SMOG?

REFERRING TO Allen D. Brandt's review of the U. S. Public Health Service report on air pollution at Donora, Pa., published in the February HPAC, we continue in Los Angeles to have temperature inversions under certain weather conditions. When these inversions occur, we get smog with plenty of eye irritants at street levels.

We now have a well established air pollution control bureau in Los Angeles county with very strict ordinances and laws to back them up. The big stacks of the oil refineries and other large and also small industries are being checked up and much money is being spent in attempting to clean up the smog. Sulphur dioxide has had the major attention. This work is making good headway with industrial offenders but just recently we had two days of very annoying conditions at street level from eye irritants.

I have suggested at various times that automobiles, trucks and busses do an excellent job of producing aldehydes and other contaminants right at street level. If nature does not provide upward currents of air they stay close to ground level and then you have an excellent source of smog.

Most mechanical engineers are familiar with the stringent ordinances covering garage ventilation. I recently turned out some plans for a shop building in which automobile engines are repaired and then tested with a connection to a tight exhaust duct system made with a hose connected to the engine exhaust pipe. The regular garage exhaust system was not considered sufficient protection for the mechanics.

It would be interesting to know whether engineers of the division of industrial hygiene of the U. S. Public Health Service have sampled automobile exhaust gases at street levels under temperature inversion conditions and then analyzed them for aldehydes or other contaminants which might have been contributory to the Donora deaths and cases of illness.—O. W. OTT, consulting mechanical engineer.

## SUPPORTING & ANCHORING PIPING SYSTEMS

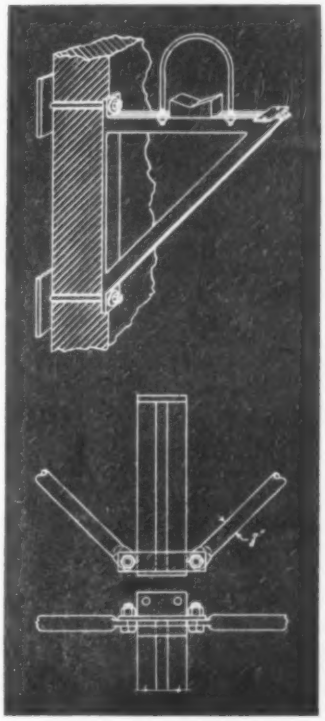
A PIPING SYSTEM which is otherwise well designed may prove a dismal failure or the source of unwarranted expense in maintenance if proper attention has not been devoted to means for supports, suspension, anchors, and the like. Robert C. Soronen's article in the March HPAC is timely because not too much has been published on this subject of anchoring and supporting piping and it would be helpful if others were encouraged to contribute such data.

Mr. Soronen's presentation and his excellent illustrations may be amplified by the following comments which are additive in detail and constructive in intent.

His illustrations detail the various types of anchors and supports as fastened to the building walls through anchor bolts. This is satisfactory when smaller piping and light loading is involved. However, in many instances—and particularly for anchors—a more substantial means of securing to walls appears desirable. This can be accomplished by using through bolts plus back plates, the latter being used to distribute the weight. The load imposed by the weight on the bracket, as well as the construction of the wall, should determine the size of the back plates. In some installations it is advisable to reinforce the back plates with additional steel in the form of a plate or angle to distribute the load over a greater section of wall area.

His illustration of the anchor welded to a wall bracket omits tie rods which should be extended diagonally from the outside edge of the bracket to the wall. Provision can be made for such tie rods by

***Top*—Illustrating the use of back plates when bolting a welded steel bracket to a wall. *Bottom*—Attachment for tie rods on welded steel brackets**



welding a flat plate to the bracket. The advantages of this precaution are obvious.

Rather than follow an arbitrary system of spacing supports and hangers at given intervals according to pipe size, it is suggested that consideration be given the relationship between spacing of pipe supports and average gradient of the line. Useful data and charts which cover this phase of piping suspension are available (see cut).—G. W. HAUCK, manager of engineering sales, Crane Co.

## WEIGHT OF MAGNESIA INSULATION

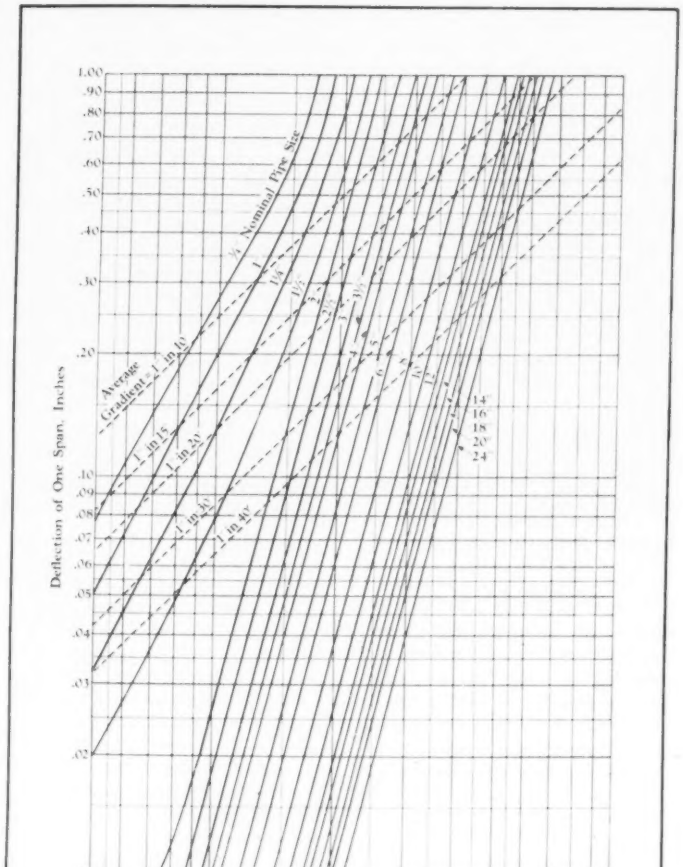
IN HIS INTERESTING article on How to Space Pipe Supports, published in the October, November, December and February issues of HPAC, Theodore E. Bridge included data on the weight in lb per ft of 85 percent magnesia insulation for various thicknesses and pipe sizes. The Magnesia Insulation Manufacturers Association, cognizant of the importance of such data in connection with the design of pipe supports, has included a table based on magnesia weights currently in manufacture in its recently published manual. These figures include the weight of normal accessories and finishes.

In comparing the two sets of data, we find that Mr. Bridge's figures are, in some cases, 5 lb higher than those given by the association. It may be that Mr. Bridge used a density figure for 85 percent magnesia which is no longer characteristic of the material today.

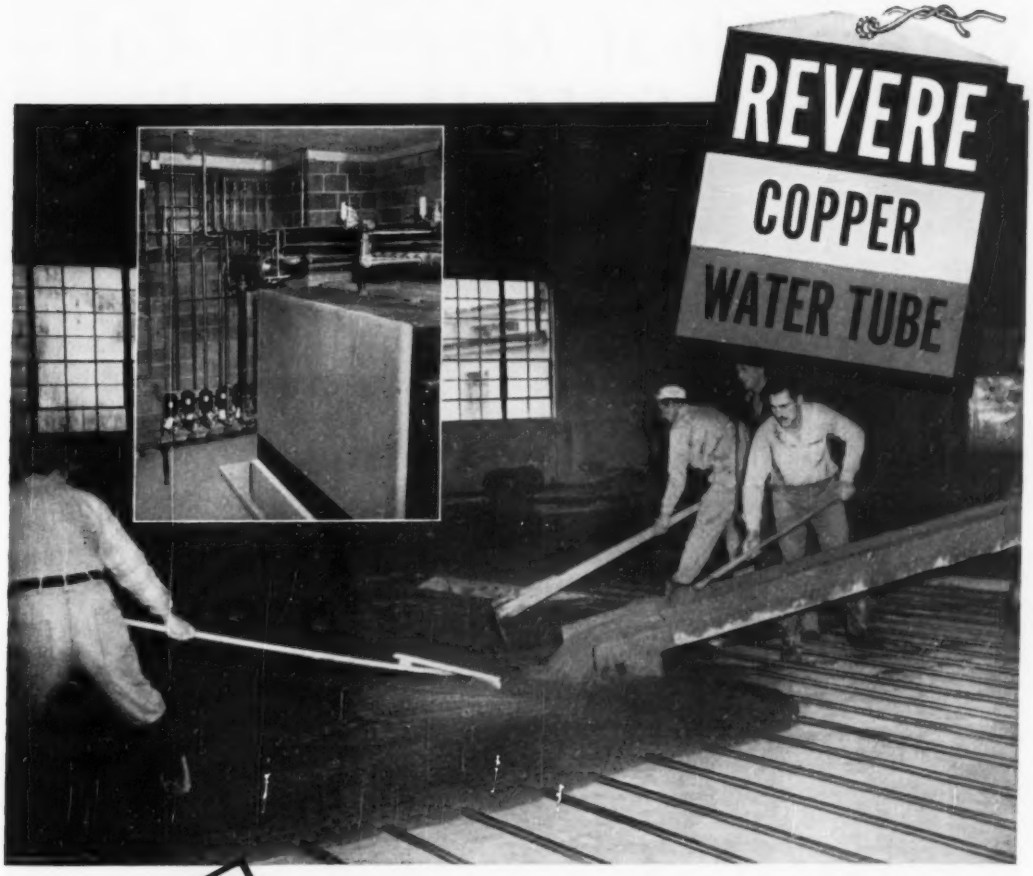
Engineers interested in the latest data on weights of this insulating material can obtain a copy of the 85 percent Magnesia Insulation Manual by writing to the association, at 1317 F St., N.W., Washington 4, D. C.—MARSHALL F. ALLEN, manager, Magnesia Insulation Manufacturers Association.

## NEW YORK LIMITS WATER FOR EXISTING JOBS

A DIRECTIVE of New York City's department of water supply, gas and electricity requires existing refrigeration installations using between 5 and 50 gpm to be equipped with recirculating units to conserve water by June 1. If operators fail to comply, their water supply will be turned off, it was said. Previous directives required large installations—and new ones—to have conserving equipment.




**Deflection of horizontal pipe lines, based on standard pipe filled with water. *Example:* To determine maximum distance between supports for a 4 in. standard pipe line and assuming a pitch or average gradient of 1 in. in 30 ft, proceed downward from intersection of diagonal dotted line for average gradient of 1 in. in 30 ft and diagonal solid line for 4 in. pipe to bottom line, where it is noted that the maximum span is approximately 22 ft**




*Concrete is being poured over 1" Type L Revere Copper Water Tube in this radiant panel heating installation at Driscoll Chevrolet Agency, Spring Valley, New York. Boiler and zone circulators are shown in inset.*

*Architect: Joseph M. Pilati, Pearl River; General Contractor: Harvey B. Keesler, Spring Valley; Heating and Plumbing Contractor: Irving Keesler, Spring Valley; Consulting Engineer: Roger M. Wells, Bayside, Long Island.*

# OK ...for RADIANT HEATING

REVERE Copper Water Tube is used to advantage in either floor or ceiling installations of radiant panel heating. Its strength and resistance to corrosion assure long service. Joints made with solder fittings keep installation costs surprisingly low.

Hard temper Revere Copper Water Tube comes in straight lengths of 12 or 20 feet. Easy-to-bend soft temper tube is available in similar lengths or in long coils.

Revere Copper Water Tube is also suitable for industrial uses. Type B Copper Tube is available for installations requiring outside diameters of SPS pipe and brazed fittings; Red-Brass Pipe and Copper Pipe for use with threaded fittings.

Revere pipe and tube are handled by leading distributors in all parts of the country. The Revere Technical Advisory Service is always glad to serve you.

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**COPPER AND BRASS INCORPORATED**

*Founded by Paul Revere in 1801*

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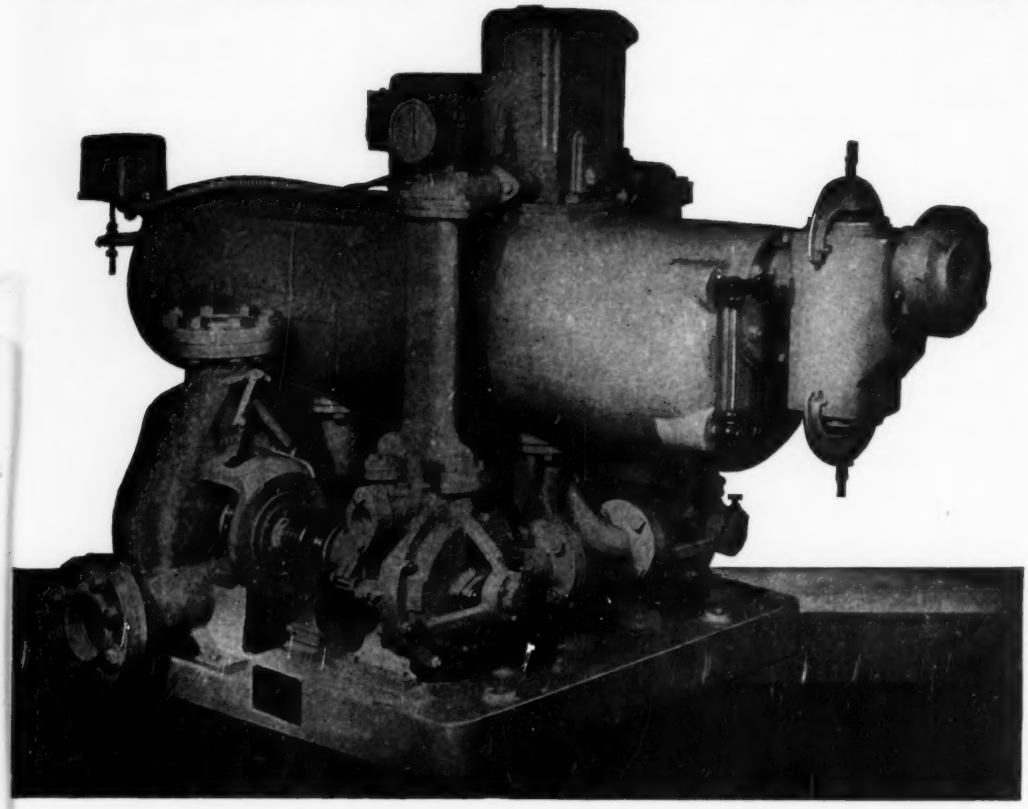
*Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.*
*Sales Offices in Principal Cities, Distributors Everywhere.*

# Where Heat Must Not Fail— Install this SAFE Heating Pump!



In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is entirely independent of electric current failure, and continues to operate as long as there is steam in the system.

More than that, the Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump.

Greater savings still are effected by the Vapor Turbine in the system, for the reason that this pump operates continuously. It is the only pump that can do this with economy. Continuous operation means uniform circulation, and uniform circulation saves steam.

The Nash Vapor Turbine has but one moving part, rotating in the casing without metallic contact, and requiring no internal lubrication. Quiet, compact, and trouble-proof. Bulletin A-290 is free on request.

## THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

*For service during the heating season, a booster heating coil is placed in the supply duct at the store entrance. It is controlled by a thermostat located in a representative area near the front doors*

# How Lerner Air Conditions Its Women's Apparel Chain Stores

AIR CONDITIONING a women's apparel chain store differs somewhat from the average utility shop. A woman will spend from 20 min to well over an hour in our stores when she purchases a dress, coat, or suit, and thus the importance of providing conditions of comfort continuously throughout the year becomes readily apparent.

Air conditioning in a women's specialty store affords comfort and an appreciable merchandise saving. Obviously, by providing comfortable conditions, the customer is in a more receptive mood for making purchases. While not universally understood, this is of considerable importance. Air conditioning saves the owner of a store a large amount of money annually by preventing spoilage of clothing during the cooling season, particularly so in regions of high wet bulb areas such as are encountered along the Gulf of Mexico. Ordinarily, without air cooling much merchandise would be spoiled because of perspiration and smudge stains caused by a customer entering the store from the oppressive outdoors and trying on clothing. A "precooled" customer who tries on a dress does not spoil merchandise.

Problems encountered in designing an air conditioning system in a women's shop are numerous and interesting. Matters which often appear insignificant and unimportant require considerable attention for satisfactory operation of the heating and cooling systems.

### Front Doors a Problem

For example, front doors offer an all too often troublesome problem. In a busy store, entrance doors are

*BRUCE A. JACOBI, chief engineer of the Lerner Stores Corp., discusses here the general problem of air conditioning women's apparel chain stores and includes practical comment on problems of design, maintenance and operation. He devotes special attention to the heating and cooling of entrances and show windows, the effect of changes in store lighting practice on cooling, and temperature control in general sales areas and in the fitting rooms*

being opened practically continuously—so much so that we now calculate cooling loads based on the assumption that entrance doors are wide open at all times. With the doors open, it becomes necessary to develop a positive air pressure at the store entrance and to provide for an exfiltration of air into the store lobby. This is usually accomplished by adjusting the return air damper on the sales floor until a positive pressure condition is obtained at the store entrance. However, in tall buildings, a stack effect is frequently prevalent and the return air damper adjustment in itself will not be sufficient to effect an exfiltration into the lobby. When such a condition is encountered, a supply outlet is placed above the entrance doors on the inside of the store. The outlet is designed to deliver a sufficient quantity of air to blanket any infiltration.

An interesting byproduct of this type of summer operation is the semi-cooled lobby. I have noted in many of our southern stores (which of course are located in commercial areas) that business girls, particularly during their lunch hour, will frequent the store lobby to obtain some comfort. The advertising value resulting from the show window displays facing the lobby is quite evident.

A good example of a "cooled lobby" is our New Orleans store, which was built just before the war. We designed seven tons of cooling for the lobby. This was most effective. When Mr. Lerner and I visited the store during the cooling season, we noticed a rather awkward condition. The lobby was crowded with people enjoying free air conditioning. In fact I should say, so crowded, that it was difficult for a customer to gain passage through the people to enter the store.

For the heating season, a booster heating coil is placed in the supply duct at the store entrance. This coil is controlled by a manual switch located in a representative area near the front doors. In some instances a manually controlled unit heater is recessed in the wall near the entrance. Store managers do not approve of storm doors with added vestibules during the winter, contending that the increased number of doors presents a customer hazard. Therefore, provision for booster heating at the front entrance is extremely important and requires considerable detail to prevent over or insufficient heating at this point.

In our larger stores—that is, stores over 40 ft wide—we have multiple entrances. In these stores a separate centrifugal blower is installed in the hung ceiling above the entrance or in the basement below it. A duct system with high velocity ejectors is installed across the entire width of the front entrance. Cooling and heating coils are installed in the front entrance duct system.

One of the most critical problems in store heating or cooling occurs at the front doors, and if adequate provision is made for this area, then the heating and cooling in the main sales area is indeed easy. However, if entrance doors are not given proper consideration, then no matter how carefully the remainder of the store is designed, the results in terms of comfort are likely to be disastrous.

### Fitting Rooms Get Special Treatment

The fitting room presents a severe problem in air conditioning design because this area has a more concentrated occupancy than any other part of the store. The room is completely enclosed with a low ceiling, usually 8 ft high, and is entirely separated from the sales area. Customers spend more time in the fitting room than in any other part of the store, and a large percentage of sales is made in the fitting room cubicle. We have found it advisable to install a separate duct from the fan outlet into the fitting room area. A booster cooling coil connected to a small condensing unit is installed within this duct. A booster heating coil is also placed in the fitting room duct.

Through experience, we have found that this area normally requires a slightly higher temperature during the cooling period and also during the heating season, as compared to the general sales area. Our experience indicates that there should be a 2 to 3 deg differential between the fitting room and the general sales area. Moreover, because of the high occupancy concentration, a sufficient amount of outside air must be circulated to prevent odors and this air must be rapidly exhausted. We usually discard the exhaust air from the fitting room to the outside by means of a small utility type blower. It is never recirculated.

Zoning is important where more than one sales floor is encountered. In smaller stores, each sales floor is zoned by automatic volume dampers during the cooling season and by thermostatically controlled booster coils during the heating season. In large stores it is usually more desirable to install a separate conditioner complete with filters, cooling and heating coils, and a fan for each floor. Economy and ease of operation are the decisive factors in determining which type of zoning to employ.

More recently, we have favored the double plenum, hot and cold deck, blow through system. Thermostatically controlled dampers regulate conditions in each zone. The double plenum system has the advantage of concentrating all air conditioning equipment in one room. It possesses a vast amount of flexibility in being able to divert heating and cooling loads from regions where they are less required to areas in which there is a heavy concentration.

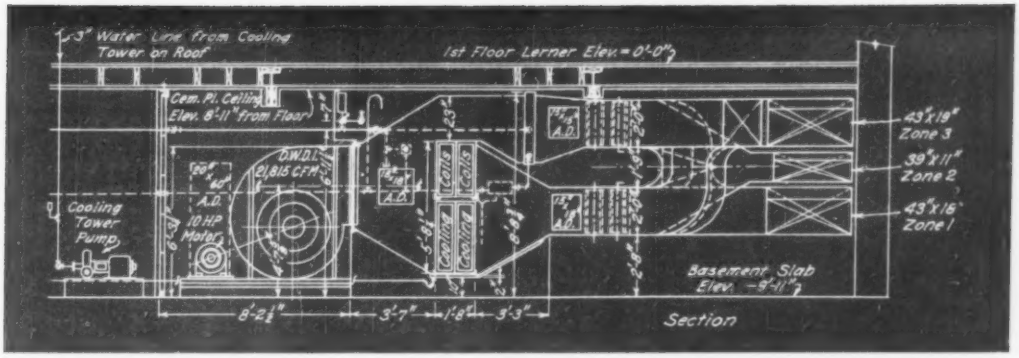
### Air Outlets Should Not Be Apparent

Air distribution presents a different problem for each store. Hung ceilings allow for an architectural blending of store lighting with ceiling air outlet arrangement, and this is particularly important in effecting draftless distribution. It is my contention that air outlets, like sources of light, should not be apparent to the customer and wherever possible should be hidden or placed in an obscure location.

Women in particular are sensitive to drafts and we must take special pains to avoid any type of air distribution which will result in a draft.

### Flexibility Provided in Design

We have found it advisable, in designing air conditioning systems for our stores, to specify two or more parallel units, each complete in itself, rather than one large central air conditioning unit with one blower. With such an arrangement, flexibility and ease of operation are obtained. A particular advantage occurs in case of a breakdown.




**Elevation of typical double plenum system as used in a number of the Lerner corporation's stores**

Should one unit become inoperative, the other will still function and thus only a portion of the store will be without air conditioning during the breakdown period. Moreover, we design the smaller units so that one may be bypassed into another. If necessary, then, the air supply from one unit may be called upon to help another area with a depleted air supply. Although it is usually more expensive to install several smaller units, the saving over a period of years obtained through flexibility of operation and better air conditioning more than offsets the initial equipment cost.

Of considerable importance is the problem of dust elimination. We have found it advisable to have our throwaway type filters serviced periodically, and to replace them regularly three or four times during the year. We have established a definite filter program and advise the service companies when to change filters. We in turn follow through to make sure that filters have been renewed at the time the request was made. Much of the dust entrapped by filters in our shops is lint. This causes filters to clog more rapidly than they would normally. Therefore, we insist our filter service man clean the filters twice each month, using a vacuum cleaner or other suitable equipment.

Since an air conditioning system does not improve with age and use, we have found it a poor policy to size the cooling system to meet exactly the calculated design conditions. All our air conditioning equipment is slightly oversized and thus when inefficiencies develop due to dirt collection on coils or normal wearing of parts, the capacity of the system will still be sufficient to meet the required load. The importance of this condition was emphasized during the war. Occupancy in our stores increased three- four- and five-fold and since our systems were oversized, we were able in many instances to maintain comfortable conditions with the increased occupancy load.

## Store Lighting Changes Affect A.C.

It is interesting at this time to point out changes in store lighting design and their relationship to air conditioning. For several years before the war, interior store lighting was designed to maintain the level of 25 to 30 foot-candles. We now design general lighting for a maintained level of 35 to 50 foot-candles. However, because of color effect, we do not use fluorescent lighting for our primary source of light, but confine it to decorative treatment. Thus, the increased lighting, which is mostly incandescent, results in larger air conditioning systems and a high sensible heat load.

Another modern tendency in store design is the elimination of show window backing. Formerly, a 4 in. thick insulated partition separated show windows from the main sales area. Today, these backings are eliminated and from an air conditioning consideration, two problems have resulted. The entire light load in the show windows is now directly transmitted into the sales area. Normally, show windows are lighted along their periphery with about 150 watts per running foot. It can therefore be readily appreciated that elimination of the show window backing increases the load required for cooling.

In addition to the lighting problem, the sun effect in many stores becomes increasingly more important. Formerly, when the sun shone directly into the show windows, and an adequate backing was provided, the sun effect could be neglected in calculating the cooling load for the store. Now, however, depending upon the location of the store, the sun frequently shines directly into the sales area and the solar effect can no longer be disregarded in the design of the air conditioning system. During the heating season, we are experiencing the additional problem of increased heat loss through show windows. Glass of low thermal conductivity may greatly alter this condition; we have not used enough of it yet to arrive at a definite conclusion.

To overcome the increased loads caused by elimination of show window backing, we are installing air conditioning outlets in the show window proper. This has proved rather successful not only in taking care of the heat loss and gains at the source, but in providing comfort four our window trimmers—and in increasing their efficiency. Moreover, certain display materials tend to wilt under conditions of intense heat. Air conditioning has eliminated this problem.

In northern climates we sometimes have show window frosting and condensation. We have eliminated this problem by providing a concealed blower and heating coil above the show window ceiling. The blower is so placed that air is directed against the show window glass surface. The higher air veloc-

## *STANDARD SCHOOL BUILDINGS DEVELOPED*

STANDARD ELEMENTARY classroom wings designed for the Montgomery county, Md., board of education incorporate new design and construction features, to take the modern elementary school out of the "little red school house" era. The general contract for seven of the school wing units was recently let.

The functional design, by Ronald S. Senseman, architect, will provide elementary pupils with modern developments in school construction at a saving to taxpayers through standardization. A. Dee Counts is the mechanical engineer on this project.

These structures are formed of simple steel bent construction, consisting of continuous column beams tied together—two to a classroom. The steel decking welded to these beams becomes the ceiling of each classroom when acoustical tile is cemented directly to the underside. The columns require the only footings for the buildings. The bent construction permits a continuous run for the windows in the exterior walls as well as in the clerestory wall atop each wing. Windows in the clerestory walls provide ventilation and additional light to the classrooms.

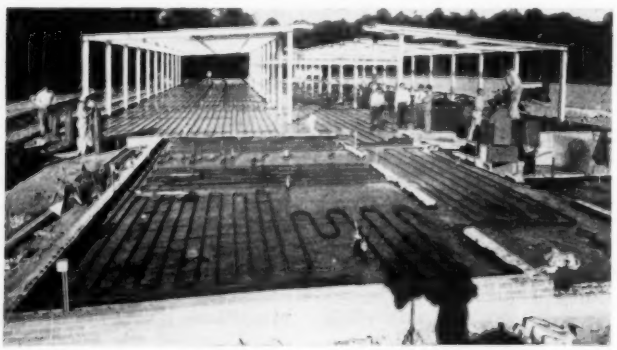
The aluminum sash are designed especially for glass block construction, eliminating additional supporting steel over the sash.

All cinder block partitions throughout the buildings are laid to eliminate cutting, so that the full length of the block may be used. These cinder blocks will be painted and will form the finished surface, except in the corridors and toilet rooms, which will have salt glazed tile wainscoting.

All of these one-story, steel and masonry buildings will be radiant heated by hot water circulating through 1 in. wrought iron pipe coils laid on 12 in. centers in the floors. Each room has a sinuous coil and individual heat control. The heating boiler for each school building is oil fired.

Every effort has been made to provide minimum maintenance, together with ease of expansion, each school having been designed as a complete unit, the first section forming one wing of the complete elementary school. All the schools are to be built on well-selected, spacious sites, properly oriented for east-west exposure. A large portion of each site will be graded, seeded and sodded. Paved parking areas, large macadam play areas, and soft ball diamonds are also planned.

**One of the elementary classroom wings being built from standardized plans, showing the piping for the floor radiant heating system**



ity with increased heat allows for a greater moisture carrying capacity in the show windows and thus prevents frost or condensation.

A properly organized maintenance program is important for a successful operating season. We employ a group of field service men who regularly visit each of our stores. These men contact local service companies and see that the air conditioning systems are maintained in excellent operating condition. We negotiate a standard service contract with a reputable service company in each locality where we operate a store. This company checks the air conditioning system twice a month during the heating and cooling season. We attempt to *prevent* breakdowns rather than *cure* them.

At regular intervals, compressors are opened and inspected, fan belts are renewed, cooling and heating coils are cleaned, cooling towers and evaporative condensers are cleaned as necessary. Boilers and gas heaters are thoroughly cleaned and serviced before each heating season. Chimneys are vacuumed once a year.

Whenever possible, all maintenance and repair work is done during the off-season period. Every effort is made to have all cooling and heating systems in perfect condition so that other than normal lubrication and inspection during the operating season, nothing else will be required.

### Conflict Between Customers, Personnel

It has often been said that an air conditioning system is no better than the controls which operate it. Basically, this is correct but in our stores there is an eternal conflict between store personnel and customers. Thus, with the controls set to satisfy the personnel, the customers are too cool. The net result, however, is that while the controls are set to favor the customer, we try to arrive at some compromise that will please our sales personnel.

We attempt to educate the managers of all our stores so that they will know, in a layman manner, the principles of air conditioning. We want to educate them so that they will know what to expect—or better still, what not to expect—from their comfort equipment. We instruct them to call the service company in the event of any unusual difficulty.

**Close-up of two valves in the manifold, showing how a cam or lug has been welded to the wrench handle to engage the roller arm actuator of the pump control switch when the valve is in a full open position**

# Safety Brackets Allow But One Valve Open at a Time

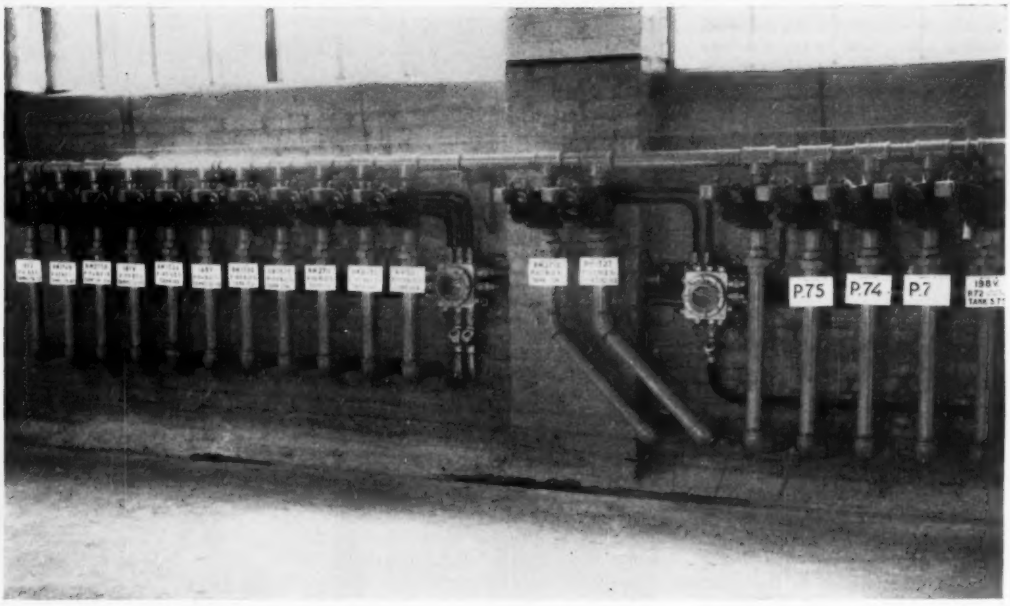
***THE PROBLEM** was to prevent the accidental opening of more than one valve at the same time on a common manifold. It was solved by a specially designed safety bracket which prevents the operating wrench from being removed from any one of the lubricated plug valves when the valve is in the open position*

THE ARMSTRONG Paint & Varnish Works, Chicago, was faced with the problem of preventing the accidental opening of more than one valve at the same time on a common manifold. Clarence Dunn, the plant engineer, solved this problem by using lubricated plug valves in a typical manifold and designing safety brackets for the valves. These valves afford a quick, sure opening or closing with but a quarter turn of the plug, and because of their design are especially advantageous on lines containing viscous fluids.

The main purpose of the lubricated plug valve safety bracket, on which Mr. Dunn has applied for a patent, is to prevent accidental opening of more than one valve at the same time. The bracket is installed on straightway type lubricated plug valves where two or more valves control the flow of pipe lines entering a common manifold. One operating wrench is provided for the group of valves in the manifold. This wrench is secured to the manifold by means of a chain or wire just long enough to reach all the valves in the manifold. Due to the construction of the safety bracket, the operating wrench cannot be removed from the valve when the valve is in the open position; therefore the valve must be closed before the wrench is free for use on another valve.

In addition to the safety feature, the bracket also provides a mounting space for an electrical switch for remote pump control where that is desired.

One of the accompanying photos shows 18 pump lines terminating in a common manifold leading to the weight scale hopper of a 2000 gal process kettle in the varnish department. All of the lines are fitted up with 2 in. lubricated plug valves, using the safety bracket with a pump control switch mounted on it. As will be noted in the photo, a tightly stretched wire is installed directly above the manifold. The




operating wrench is suspended from this wire by a short piece of chain. The wrench can be carried from one end of the manifold to the other by sliding the chain along the wire.

The other photo shows a close-up of two valves in the manifold. In this photo it can be seen how a cam or lug has been welded to the wrench handle. This cam engages the roller arm actuator of the pump control switch when the valve is in a full open position. The control circuit switches are the explosion-proof type. The actual motor starter is a magnetic type usually mounted near the pump, which may be located quite some distance from the manifold. (Photos courtesy Walworth Co.)

**Each of these 18 pump lines terminating in a common manifold leading to the weight scale hopper of a 2000 gal process kettle in the varnish department is fitted with a 2 in. lubricated plug valve equipped with a safety bracket**

## WE COUNT OURSELVES THIS MONTH

THIS MONTH, 140,000 enumerators of the Bureau of the Census of the United States Department of Commerce will take the 17th decennial census of the nation. These enumerators will travel an estimated 25 million miles to call at about 45 million dwellings, in thousands of cities and towns and on six and one-third million farms—to enumerate an estimated 151 million persons. The census bureau will tabulate about 15 billion facts these census takers collect.

The census will be directed out of more than 450 field offices in the 48 states and U. S. territories and island possessions. U. S. consular offices will carry the enumeration into foreign lands where Americans are residing at the time of the census. Military personnel serving overseas will fill out special census forms, as will members of ships' crews at sea and in ports.

The actual census enumeration is scheduled to be completed by the end of April. It will take until December 31, 1952, to complete all the tabulations for reports to be published. Provisional population totals will be announced locally for cities and towns as quickly as the 450 district census offices are able to complete preliminary counts.

The 17th decennial census in reality is a combination of three major censuses. They relate to population, housing, and agriculture, including irrigation and drainage projects. These three censuses are taken at the same time because the census taker can collect the information for all of them in a single visit. This means a great saving in field costs. Even more important is the fact that all the information collected as of the same date, April 1, provides a complete statistical picture of the nation's people, dwellings, and farms with all items in focus as to time of enumeration.

An estimated 19 million inhabitants have been added since 1940 when the population stood at 131,669,275. The next highest increase was 17 million between 1920 and 1930. Between 1930 and 1940 the increase was only 8,894,229, the lowest for any decade since the 1870's. A sharp rise in the number of births and a simultaneous decline in the death rate are responsible for the unprecedented population growth in the last decade.

The 1940 census of housing counted 37.3 million dwelling units of which 34.8 million were occupied and 2.5 million were vacant. While no official estimate on the present number of dwelling units is available, the census bureau has made preparations for enumerating as many as 45 million units in the 1950 housing census. While construction of new dwellings was held to a minimum during World War II, millions of new dwelling units have been built since that war and hundreds of thousands more are nearing readiness for occupancy.

# PRINCIPLES OF AIR CONDITIONING

## *Control of Humidity and Temperature as Applied to Manufacturing Processes and Human Comfort*

THE CONTROL OF atmospheric conditions within an enclosure with reference to temperature, humidity, and cleanliness is termed *air conditioning*. The importance of this field of engineering is now widely recognized, not only in engineering circles but by the public at large.

It has long been recognized that relative humidity is an important factor in the manufacture and processing of certain hygroscopic materials such as textiles. Since the normal relative humidity in textile factories is nearly always lower than that desired, various artificial means have for many years been provided to increase the humidity.

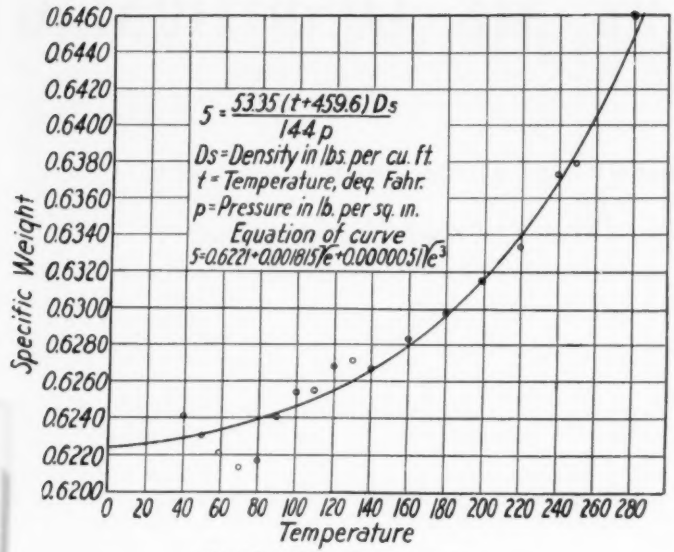
On the other hand, there are industries which require a definite and unvaried humidity so that at some periods the normal quantity of moisture in the air must be increased, and at other times lowered. Among such industries may be mentioned the manufacture of confectionery, the processing and weaving of artificial silk, and the printing and lithographing industry.

Other industries require not only a constant relative humidity but also a fairly uniform temperature. An example of this is seen in automatic wrapping machines, used for wrapping chewing gum, food products, confectionery, and cigarettes, which require exact conditions of heat and moisture in order to function satisfactorily without frequent adjustments.

In the manufacturing and processing of most hygroscopic materials there are usually one or more stages in the process in which moisture has to be removed from the material. In all such products which are not in themselves soluble in water, this is usually accomplished by air drying.

In order to avoid injury to the products which require temperature and humidity control, the rate of moisture removal must be controlled with accuracy in certain stages of the process, while at the end of the process of drying it may be extremely important to control with accuracy the final moisture content of the material. This is true in the manufacture of the various tobacco products, artificial silk, certain gelatine products including photographic films, lumber, paper, and macaroni. In many of these products it is not only necessary to have this final moisture content to insure the desirable qualities of the product itself but to standardize its moisture content from the standpoint of sales value.

WILLIS H. CARRIER, chairman emeritus of the board, Carrier Corp., honorary member, life member, presidential member of the American Society of Heating and Ventilating Engineers, prepared (with the assistance of a committee appointed by the ASHVE) and presented at the 1929 World Engineering Congress at Tokyo an extensive paper on air conditioning for process and comfort which was published in the November 1929 issue of HPAC. Because of its importance and its thorough treatment of the subject, HPAC's editors recently asked Dr. Carrier to bring it up to date for publication now that "air conditioning has come of age." . . . During the 20 some years which have elapsed since the paper was originally written, there have been many developments in the art of air conditioning which have been well integrated into the air conditioning industry. Some apparatus, current then, has been replaced by new and more efficient designs. The 'Freon' refrigerants, made available in the early 30's, contributed to the development of small cooling units. The new systems for air conditioning multiroom buildings have reached a high degree of perfection. Refinements have been made in psychrometric data which have scientific significance but do not affect engineering calculations except in particular cases. They are all evidence of progress. However, they do not materially alter the picture presented 20 years ago. So much of the original paper is still in effect that it needed only to be edited to bring it up to date. With some additions, some deletions, and the changing of the tense of some verbs, and a substitution of current nomenclature and illustrations, the 1929 paper becomes current. . . . The first part of the revised paper appears this month, with publication completed in following issues




**Specific weight of water vapor**

Air conditioning is important in certain branches of the chemical industry in controlling the temperature of reaction and facilitating or retarding evaporation.

The control of the moisture content of air supplied to blast furnaces in the manufacture of pig iron has proved advantageous, and with present improved methods of moisture removal from the air, this field may become prominent. (The evidence that this supposition was correct are the installations of conditioning systems for blast air for 11 furnaces in 1939 through 1942).

In many instances, air conditioning combined with ventilation may be commercially desirable from the standpoint of human comfort rather than primarily for the effect upon the products themselves. In many industries the output is affected, and in some cases limited, by the capacity of the workers. This output is therefore greatly augmented by the proper control of temperature and humidity conditions, when normally they would be so unsatisfactory as to depress in marked degree the factory output. This is particularly true in the cotton mill industry, in steel rolling mills, in hot climates like India, in deep mines particularly in Brazil, India, and South Africa, in the manufacture of glazed iron ware and similar processes.

For instance, in such industries as lithographing, the question of the quality of the product and the personal comfort of the employees assume almost equal importance. So that the proper register may be obtained, with the application of the colors in different processes, a very exact humidity is necessary, and in hot moist weather such conditions can only be secured by dehumidification and mechanical refrigeration, except at the price of great human discomfort. In other industries, the product is affected by both relative humidity and temperature, as in the manufacture of chocolates, chewing gum, cigarettes and machine-made cigars, where it is necessary to humidify during some parts of the year, and to dehumidify and refrigerate at other seasons, in order to maintain a uniform condition both of temperature and humidity within the limits permissible by the products. It happens in these instances, as in many others, that the atmospheric conditions best suited to the products and process are almost ideal for the health, comfort and efficiency of the workers.

Besides the industrial uses of air conditioning, it has great commercial importance in its application to personal comfort alone, where large numbers of people are congregated in auditoriums, theaters and department stores. In such cases, ventilation with cooling and dehumidification have been proved to offer high economic returns.

In one of the early cinema installations, the cost of installing such equipment was approximately $65,000, and the increased box office receipts during the first summer's operation over the previous summer, without such a system, exceeded $70,000. Hundreds of installations have been made throughout the United States and others will be found throughout the world. The use of such installations has rapidly increased.

Air conditioning with refrigeration has been found practically the only satisfactory method of securing the desired degree of comfort during days of special summer sales and at other rush seasons in large department stores. It has been found to add materially to the profits in the operation of such stores. One of the large stores in Detroit was the first to install a modern air conditioning system with refrigeration. In this initial installation the refrigeration capacity was 600 tons. A large addition to the same store required over 1000 tons of refrigeration in conjunction with the air conditioning system for the same purpose, and when it is remembered that refrigeration cost at that time nearly $200 a ton to install and that the cost of the refrigerating equipment represented approximately one-third of the entire installation, the dollars and cents value to this firm of such an installation can be appreciated. (The store now has a total of 5300 tons).

The use of air conditioning with refrigeration in hotels, restaurants, banks, and office buildings is likewise rapidly increasing.

Air conditioning as applied in textile mills has made possible, in the United States, a shifting of the center of this industry from the New England states in the north where the climatic conditions are advantageous to the less favorable climatic conditions of the southern states, but where the cotton is grown and labor is available.

By means of air conditioning the desirable conditions of temperature and moisture are maintained in one climate equally as well as in another. In tobacco factories it has resulted in a saving which, in some instances, paid for the equipment

required in less than one month's operation due to the elimination of waste material and general improvement in efficiency. A great speeding-up of operation in large cigarette factories throughout the United States and avoiding shutdowns and delays followed the use of air conditioning, while in textile factories it has permitted continuous operation without the delays required in the adjustment of loom fixtures for variable atmospheric conditions. In such industries, the accurate control of humidity at a definite point is of as much, or more, importance than the humidity itself.

## History of Development

Prior to 1905 there had been numerous devices used, principally in textile mills, for atomizing water into the air to increase the moisture content. These were controlled by turning on and off such devices manually. A few spray air washers were in use in public buildings which likewise added to the moisture content of the air. There was, however, an entire lack of definite methods of humidity control, nor were these devices applied industrially.

Subsequent to this date, Johnson, Cramer and Hodge, Carrier, Comfort, and others, devised various practical methods and instruments for the definite control of relative humidity. The air washer was improved to such an extent that it produced complete saturation of the air and was applied in the ventilation, cooling and humidification of textile mills and other industrial establishments.

The spray type of dehumidifier also made its appearance about this time. In this system the air was cooled and the moisture extracted therefrom by a specially designed type of air washer in which the effect was produced by a direct spray of mechanically-cooled water upon the air rather than through coils of pipe in which cold water or brine was circulated, as had been the method theretofore. All the water vapor was thus condensed from the air to the point of saturation at the temperature corresponding to that of the air leaving the dehumidifier and all free moisture was removed by a series of baffles or eliminators, in much the same manner as in the standard air washer. The spraying of water into the air to remove moisture from it might seem paradoxical except for the application thereto of easily understood laws of physics. This type of dehumidifier came gradually into use and is now applied to a large number of industries, and to air conditioning for human comfort in theaters, department stores and similar places.

The spray type equipment for cooling and dehumidifying air is not practical for small installations where the control of humidity is of secondary importance, as in small shops, private offices or individual residential rooms. To provide cooling for such applications the coil type of equipment is used. The development of a non-toxic refrigerant for small capacity machines, used with the improved coils developed in the early 20's, has made coil type equipment practical, economical and satisfactory for many types of installations.

## Physical Principles

The art of air conditioning is based upon very definite physical principles and the concept of these principles has not changed during the last 20 years. The phenomena involved have been given intensive study, both from the theoretical and experimental standpoint. As the result of this, the various relationships have been quantitatively expressed, either rationally or empirically.

The usual requirement in air conditioning as applied to processing hygroscopic materials is to maintain a definite relative humidity. In other instances it is desired to control merely a definite moisture content of the air.

In problems involving human comfort, it is necessary to maintain certain limiting or desirable effective temperatures which depend upon the experimentally determined relationships of wet bulb and dry bulb temperatures and air motion. Briefly, those are the requirements in various phases of air conditioning and the terms should be defined properly in order that the following discussion may be clear.

It should be noted first that the moisture content in a given space is independent of the maximum quantity of air or other gases present. In other words, the properties of saturated water vapor are assumed to be in no way affected by the presence of other gases. Therefore the quantity of moisture present in a given space may be determined directly from the data available on the physical properties of water vapor.

As is well known, the vapor pressure of water, and consequently the weight per unit of volume of that vapor depends upon its temperature. Vapor pressure and density curves and tables are available for all the ranges of atmospheric temperature, and the accuracy of these can probably be relied upon.

Where the vapor pressure of the water vapor present is known, it is evident that the proportionate weight of water vapor to other gases in the mixture obeys Dalton's law assuming, of course, that they have no chemical affinity. This may be expressed by the relationship:

$$W = \frac{Se}{P - e}$$

where $W$ = weight of moisture per pound of air; $S$ = specific weight of water vapor compared with air as 1; $P$ = barometric pressure; $e$ = vapor pressure at temperature $t$.

If other gases than air are present, then the specific weight of water vapor must be taken as the density of the water vapor with reference to the density of the gas at the same pressure and temperature.

The theoretical specific weight of steam, assuming that it obeys the gas laws, would be the ratio of the molecular weight of steam to that of pure dry air. At low temperatures the actual specific weight approaches very closely this theoretical, while at high temperatures the deviation is considerable. The curve of actual specific weights of water vapor is shown herewith [see Rational Psychrometric Formulae, Transactions American Society of Mechanical Engineers, 1911, vol. 33, p. 1020.]

From this, it is possible to compute with accuracy the weight of water vapor contained in a pound of dry air at any given vapor pressure and barometric pressure.

In a mixture of air and water vapor, a point is reached where there is a maximum quantity of water vapor present for any temperature; that is, the air is satu-

rated when the vapor pressure corresponds to the temperature.

Air, however, is usually deficient in water vapor. That is, it is unsaturated, in which case the vapor pressure is lower than the maximum corresponding to the temperature of the mixture. The ratio of such vapor pressure to the vapor pressure of the mixtures when saturated at that temperature is termed the *relative humidity*. That is:

Per cent relative humidity

$$= \frac{e}{e_t}$$

$$= \frac{D}{D_t} \text{(approximately)}$$

Where $e$ and $D$ are the pressure and the density respectively of the vapor in the air, and $e_t$ and $D_t$ are the saturation pressure and density respectively of the vapor corresponding to the temperature $t$ of the mixture.

If such an unsaturated mixture of air and water vapor be cooled, without the removal of any moisture present, it will ultimately become saturated. This temperature is termed the *dew point*, for any further cooling will result in a deposition of moisture from the mixture.

In the instance cited, the air was saturated by withdrawal of heat and without change in the moisture content.

Air may also be saturated adiabatically; that is, by being brought into contact with the liquid itself and without any addition or subtraction of external energy. Under this condition, water vaporizes into the space occupied by the air, and assuming that no heat is available from the water itself, that is, no temperature change takes place in the water present, the heat required for change of state must come from the sensible heat in the air itself, thus resulting in the lowering of its temperature.

The moisture content of the air is, therefore, increased and its temperature lowered simultaneously, and it is obvious that the increase in latent heat must exactly equal the decrease in the sensible heat of the mixture. Further, this process will go on until the air becomes saturated, where no further exchange between the sensible and latent heat is possible. This final temperature at which adiabatic saturation takes place in any body of air of known temperature and moisture content is known as the *temperature of evaporation* and corresponds to the *wet bulb temperature*.

So that no heat exchange may take place between the water and the surrounding air, it is necessary that the water be introduced at this temperature of evaporation. On the other hand, if free water is exposed to a continuous current of air of such a given temperature and moisture content, it will ultimately assume of its own accord this equilibrium temperature of evaporation. This is not only logical, but has been proved experimentally. It is for this reason that an ordinary thermometer which has its bulb covered by a wetted cloth, or otherwise coated with liquid, will, if protected against outside sources of heat such as radiation and subjected to a stream of air having a definite temperature and moisture content, indicate the temperature of adiabatic saturation. This proves the identity between what is termed the *wet bulb temperature* and the *temperature of adiabatic saturation*.

(From the 1936 paper by Carrier and Mackey, it was pointed out that the temperature of adiabatic saturation is not exactly equal to the wet bulb temperature. To quote—"Except for exact research work, the error in substituting the adiabatic-saturation temperature for the observed wet bulb temperature is negligible, being, generally, a smaller error than that probable in commercial thermometry." This refinement also supplements Item 3 of the following psychrometric principles.)

In the ordinary sling psychrometer, which is used in measuring the moisture content of air, however, there is always some radiation present and, if the wet bulb be not strongly ventilated, this error may be considerable. With strong ventilation, however, the radiation effect is usually less than 1 percent. This error depends upon the temperature and velocity of air movement, and the relationship of this error to these factors is shown in a paper presented before the American Society of Mechanical Engineers in 1924.

From the foregoing discussion, four fundamental principles in air conditioning may be evolved.

1) When dry air is saturated adiabatically the temperature is reduced as the absolute humidity is increased, and the decrease of sensible heat is exactly equal to the simultaneous increase in latent heat due to evaporation.

2) As the moisture content of air is increased adiabatically, the temperature is reduced simultaneously until the air is saturated, when no further heat metamorphosis is possible. This ultimate temperature may be termed the temperature of adiabatic saturation.

3) When an insulated body of water is permitted to evaporate freely in the air, it assumes the temperature of adiabatic saturation of that air and is unaffected by convection, i.e., the true wet bulb temperature of air is identical with its temperature of adiabatic saturation. (See above reference to 1936 paper.)

4) The true wet bulb temperature of the air depends entirely on the total of the sensible and the latent heat in the air and is independent of their relative proportions. In other words, the wet bulb temperature of the air is constant, providing the total heat of the air is constant. (See above reference to 1936 paper.)

It will be obvious in considering the foregoing process that a formula relating the latent heat change to the sensible heat change establishes the relationship of this theoretical wet bulb temperature to the temperature and moisture of the air. This was first pointed out in the rational psychrometric formula referred to previously:

$$r'(W'-W) = C_{ps}(t-t') + C_{ps}W(t-t')$$

in which $(t-t')$ = the true wet bulb depression; $(W'-W)$ = moisture absorbed per pound of pure air when it is adiabatically saturated from an initial dry bulb temperature $t_0$ and an initial moisture content $W$; $C_{ps}$ = mean specific heat of air at constant pressure between temperature $t$ and $t'$; $C_{ps}$ = specific heat of steam at constant pressure between $t$ and $t'$; $r'$ = latent heat of evaporation at wet bulb temperature $t'$.

Knowing any two of the three important values of $t$, $t'$ or $W$, it is easy to solve for the third or for any other required relation.

This is an exceedingly useful relationship, not only in air conditioning and the drying of materials but in the psychrometry of air or other gases to which it directly applies. It is evident that if the wet bulb temperature of air of a known

dry bulb temperature but unknown moisture content be determined experimentally with the wet bulb thermometer, it is possible to calculate directly the moisture content of that air from the relationship.

From this relationship, the psychrometric chart now in common use was evolved. This is most useful in all problems pertaining to air conditioning, drying and in the determination of the moisture content of air.

A formula has also been derived which will permit the approximate calculation of the vapor pressure from the wet bulb temperature observation. This is useful particularly in determining relative humidities for conditions other than standard barometric conditions for which the chart is made. The formula for expressing this relationship is:

$$e = e' - (P - e')\ (t - t')\ 2800 - 1.3t'$$

where $e$ = partial pressure of the moisture in the air, which also equals vapor pressure corresponding to the dew point; $e'$ = the vapor pressure corresponding to saturation at wet bulb temperature $t'$; $P$ = the barometric pressure; $t$ = dry bulb temperature, F; $t'$ = wet bulb temperature, F.

# *Hospital Boiler Uses Either Coal or Gas*

PRICE CHANGES, strikes, transportation difficulties and spot shortages have combined in recent years to unsettle established fuel situations with the result that there has been increasing emphasis on applying change-over combustion equipment to heating and power boilers to make dependence on a single fuel unnecessary.

The addition of a second combustion system poses some special engineering problems. Careful analysis, and, usually, a bit of ingenuity will overcome such problems satisfactorily, however.

At the Weld County hospital, Greeley, Colo., both were required to effect installation of auxiliary gas firing for an 86 hp two pass firebox equipped with a stoker which required some overfiring to handle excess load.

It was desired to retain the stoker and to have two independent firing systems—gas and coal—so as to be prepared for emergencies and to take advantage of offpeak gas rates. The new gas installation was to become the primary firing system, with the stoker held at standby for use when peak load cutoff warnings come from the gas company in accordance with the commercial gas service classification.

Where to put the gas burners was the first changeover problem, complicated by the fact that the stoker hopper took up most of the available space at the front.

Moreover, the boiler is used at two distinct pressures. Fired at 100 psi for about one-half of the day when the laundry is in use, only 50 psi is required to carry the heating load for the balance of the day.

This situation was resolved by placing two gas burner assemblies at the rear of the firebox beneath the boiler proper, leaving the stoker undisturbed. Advantage was taken of the square flanged connections in the gas burner units to set the blowers and motorized valves at right angles to the mixer-burner elements to maintain accessibility.

The two burners give a wide overall operating range from a very low minimum to an extreme maximum, and are controlled from a panel where a single switch is thrown to select 50 psi or 100 psi operation. Two pressure controls are used, one for each of the upper or lower ranges. One wiper in each control unit is set about one-quarter the total distance of travel ahead of the other. Thus, when the load is light and the burners modulate toward a closed position, one burner is cut out altogether, making possible a very low firing rate.

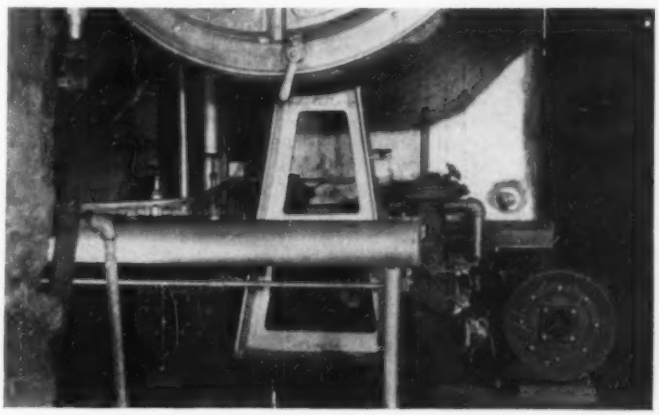
On the modulating motor operating the butterfly valve is an auxiliary switch to open the gas valve just as the butterfly starts to open. The auxiliary switch is wired through a vaporstat mounted upstream, to cancel the gas valve opening in case of fan failure. The switch is also wired through a relay which turns the burner to an off position if the burners shut down for any reason—such as low water—holding this position so that the unit always starts on low flame.

The gas burners are also supplied with automatic ignition and flame failure protection.

This arrangement makes a completely automatic system, yet one in which a coal fire can be built and put into simultaneous operation when the need arises without effect on the continuous service of the boiler.

In addition to the substantial savings in fuel cost, and the important factor of cleaner operation, the "double-headed" firing system has made possible a reduction in operating staff of one man. (Photo courtesy Bryant Industrial Div., Affiliated Gas Equipment, Inc.)

**Gas burner assemblies installed at the rear of the boiler left the coal stoker at the front undisturbed for standby use**



# *Ingenuity Plus Arc Welding* Speed Big Brine Piping Job

M. N. VUCHNICH, president of The Lincoln Electric Co. of Canada, Ltd., describes briefly in words and pictures the method of welding 45,000 ft of 1¼ in. floor piping for an ice arena. A jig comprised of four lengths of 2 by 8 in. plank to form a bed 40 ft long, on which five pairs of ordinary swivel casters were mounted to support two 20 ft lengths of pipe, was devised by the welding superintendent to speed the job of installation

A REFRIGERATION piping installation for an arena recently completed for the town of Collingwood, Ontario, Canada, presents an interesting illustration of how electric arc welding, coupled with human ingenuity, can speed fabrication of piping of this type and at the same time eliminate maintenance problems.

The arena contains an ice area 200 ft long by 83 ft wide. The brine piping for this area presented the problem of joining 45,000 ft of 1¼ in. welded seam piping, laid at 4½ in. centers parallel to the length of the area. The pipes were in standard 20 ft lengths. In addition, 4 in. and 6 in. piping for headers and return headers for the brine lines in the engine room also had to be joined.

Inasmuch as the plans called for embedding the brine piping in concrete flooring, it was deemed advisable to utilize arc welding throughout as a means of obtaining permanent and leakproof joints. Collingwood Steel Products welded the job on a subcontract from the Canadian Ice Machine Co., Ltd., of Toronto. All the piping, ranging from that 6 in. in diameter down to the ¼ in. nipple fittings used for gages, was arc welded.

To simplify the welding of the 20 ft sections of floor piping together to form 40 ft lengths, Jack Royal, the welding superintendent, devised a jig consisting of a bed made of four lengths of 2 x 8 in. plank 10 ft long. This gave a bed 40 ft long.

Five pairs of plastic swivel casters were purchased from a local hardware store and these casters were spaced along the bed to support each 20 ft section of pipe at the mid-point and at each end. The casters were slipped into holes drilled into the wooden bed and lined up so as to support the two lengths perfectly straight.

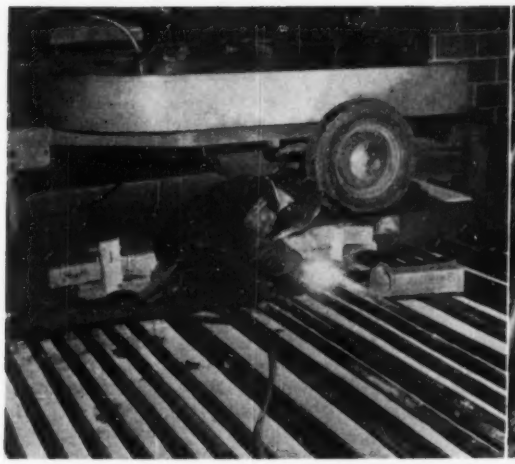
A pair of cast iron swivel casters as used in sliding doors were mounted adjacent to the weld joint and the ground connection from the welder was fastened to a steel plate on which these casters were mounted.

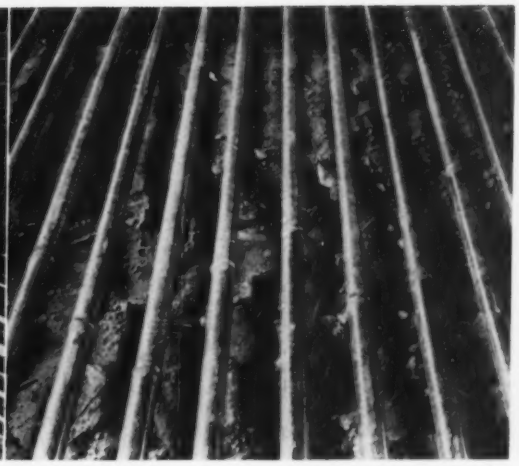
Mr. Royal first got the idea of using the swivel casters from spying his youngster's roller skates. He split two pairs of skates to give much the same type of set up but on this basis there were only four pairs of rollers to support each section at its extremities. The pipe had a tendency to sag at its midpoint, thus throwing the joint out of line, so it was at this stage of the game that it was decided to get the plastic swivel casters. These casters are the same as used on household furniture or office chairs.

Another welding operator has gone one step further and has devised a mechanical turning jig composed of an ordinary electric drill which is chucked to a reducing gear box which in turn has a chuck to fasten on to the ends of a section to be welded. In this case all the operator does is press a start button and the two sections start to rotate; he then merely holds the electrode over the joint until it is completed.

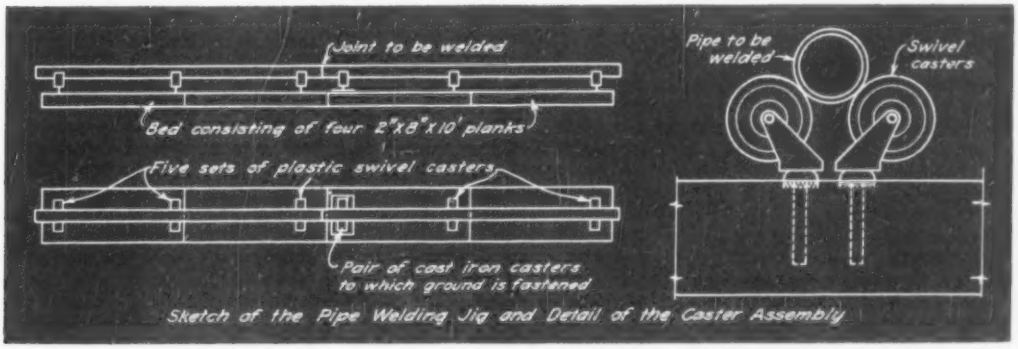
The improvised rolling jig used by Mr. Royal reduced the speed per joint to a flat 2 min. The welding of the joints was accomplished with electrodes of 5/32 in. diameter, utilizing 150 amp. The welds were completed in one pass. There were some 2400 butt joints in the 45,000 ft of piping. On test, it was found that there were only 18 small leaks in the entire 2400 butt joints and these were quickly spotted and sealed in a short time.

The headers and return headers for the brine lines in the engine room were beveled to a 60 deg included angle, and were welded in two passes with 5/32 in. electrodes at 150 amp.



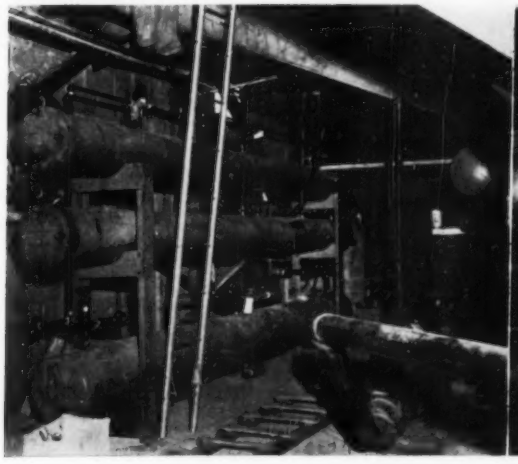


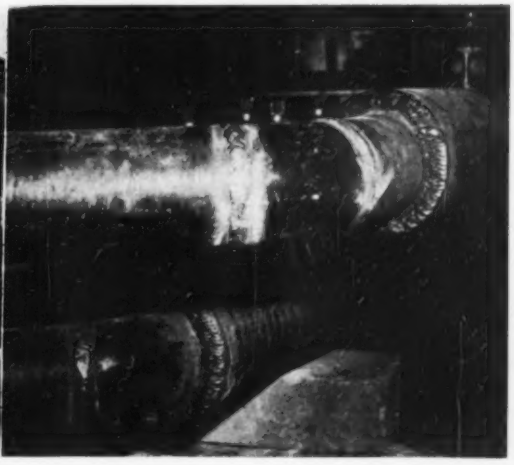
*Left*—Welding return bends in the floor piping. An ingenious rolling jig speeded the operations of placing, tacking, and welding the sections of 20 ft piping which make up the floor piping. *Right*—Close-up of part of the 45,000 ft of 1¼ in. brine piping, showing the smoothness of the completed butt welds


Joint to be welded
Bed consisting of four 2"x8"x10' planks
Five sets of plastic swivel casters
Pair of cast iron casters to which ground is fastened
Pipe to be welded
Swivel casters

Sketch of the Pipe Welding Jig and Detail of the Caster Assembly

*Left*—Arc welded headers and brine lines in the engine room. *Right*—In this view, 6 in. pipes are shown connected to 4 in. pipes, illustrating how arc welding lends itself to joining piping of different diameter





# Conditioning Aids Pursuit of Knowledge

INDOOR WEATHER control at the University of Omaha—said to be the only completely air conditioned university in the world—is a year 'round operation, and a big one. In a climate where temperatures may range from 20 deg below zero to 114 above, the conditioning system is used in 225 rooms between 12 and 16 hr a day, six days a week, serving more than 5000 persons in winter and over 2000 in summer. It was installed when the new university was erected in 1938.

One system serves three basic purposes: heating about 225 days a year, cooling approximately 100, and providing ventilation all the time the building is being used. Each process includes humidity control, circulation and air purity. During April, May, September and October, the plant frequently provides *dual* temperature operation—cooling a crowded lecture hall on one floor, for example, and heating a single occupant office on another.

### Advantages of Air Conditioning

Each summer, air conditioning is an important factor in attracting students from 30 to 40 universities across the nation. Although most of them have classes only during the mornings, many choose to remain indoors to study until lock-up time. Faculty members, too, prefer their air conditioned offices to non-air conditioned studies at home.

The university has a special study center which offers accelerated courses on the basis of 7 hr of concentrated instruction a day. Ordinarily, the center would be forced to close during the hot months, but air conditioning enables it to continue throughout the year.

The effect of conditioning on building sanitation is also a marked advantage. During a recent series of tests, Dr. Leslie N. Garlough, head of the department of natural sciences, discovered approximately between two and three times as many bacteria cultures on exposures made in non-air conditioned buildings belonging to the university as on those made within the university itself.

According to Miss Ellen Lord, head librarian and instructor in library science, the preservative value of air conditioning—to say nothing of its decided effect on student comfort—has made it essential in libraries. Controlled temperature and humidity not only prevent book pages from becoming brittle, but also protect microfilm for many years without the necessity of special storage vaults.

*Glenn D. Desmond, graduate student at the University of Omaha, prepared this article on the advantages of air conditioning for HPAC, basing his material on interviews with faculty members, students and the building and grounds staff*

The university encloses almost 2 million cu ft of volume, all of which is air conditioned except the basement housing the equipment itself. The system is intended at normal loads to supply 15 cfm of outdoor air to each occupant. It maintains temperatures between 72 and 78 deg in summer and 72 to 75 in winter. During the summer, in order to reduce shock, indoor temperatures are sometimes stepped up to a maximum of 80 deg—about 1 deg for every 5 deg change outdoors.

Because readings of 92 percent relative humidity are often recorded in Omaha, frequently half of the refrigeration effect is spent in removing moisture from the air. In the summer, humidity is maintained between 50 and 60 percent. In the winter, humidity is held between 40 and 50 percent.

For air cooling, cold water is pumped to storage reservoirs from two shallow wells. During operation, water drawn from either the wells or the storage reservoirs is pumped through counterflow heat exchangers. Additional cooling is supplied by mechanical refrigeration only when extremes of temperature and humidity require.

### Cooling Water Is Re-Used

After the water has been used for cooling, it is not wasted. Some of it is used on the lawns; a great deal of it is spilled into a ravine which borders the campus. The ravine used to be quite malodorous in the summer, but since the university began washing it out with cooling plant water, it has become sweet-smelling, making the area around it a pleasant place for strolling.

**In summer, air conditioning is an important factor in attracting students from 30 to 40 universities across the nation**

# WATER TREATMENT for Cooling Towers

DESPITE WHAT WE all were taught in elementary chemistry, water is not simply $H_2O$—at least not the water supplies provided by Nature. This fact, of course, offered the impetus which led to the remarkable developments in the science of water conditioning over the past 20 years or so and, incidentally, accounts for this discussion of one aspect of this general field: water treatment for cooling towers.

It is not within the scope here to deal with cooling towers from the standpoint of design or the mechanics of operation. Suffice to mention, however, that we find the induced draft, forced draft and atmospheric types in use with the first named more common, especially in the case of recent installations, and the "spray pond" becoming virtually non-existent.

## Types of Cooling Systems

In general, there are three types of cooling systems: the once-through system, the closed system and the open system. The heat transfer operation is generally accomplished by the conventional shell and tube heat exchanger with the evaporative cooler being used in certain industrial applications, notably the petroleum industry.

The once-through cooling system is not common for rather obvious reasons and would find application only where there is an abundant, inexpensive source of consistently cool water. This system employs no cooling tower, hence no evaporation takes place, the water merely being increased in temperature and discharged to waste. It offers relatively no scale or corrosion problems and treatment is rarely used except for chlorination.

The closed system is illustrated by the "inner-cooler" or "jacket cooler" in a diesel engine installation. The water is circulated through the engine jacket, absorbs heat and enters the shell and tube heat exchanger where it is cooled by the water from the "open system" and then the cycle is repeated. In this closed system no evaporation occurs and therefore, there is no concentration. Neither is the water subjected to aeration. Further, the make-up requirements are very low and are primarily limited to leakage. Little difficulty is encountered with scale unless extremely hard water is used for make-up and since the make-up requirements are so low, zeolite softened water is economically justified. In this sort of a system, corrosion is controlled by using inhibitors which render the metal surfaces passive.

As the name implies, the cooling effect in the case of an evaporative cooler depends upon rapid evaporation of a moisture film from the tube surfaces. By this process any type of dissolved mineral tends to deposit on the metal surfaces; therefore, peak efficiency of the evaporative cooler calls for a water supply from which virtually all dissolved minerals, of whatever kind, have been removed.

It is not intended to minimize unduly the difficulties encountered in operating the types of systems briefly mentioned above. But it is obvious that the open circulating system, which includes the conventional shell and tube heat exchanger, presents a wider range of problems than do the others.

In general, difficulties arising from the use of cooling water are

*JOHN B. DAVIS, engineer in charge of the chemical sales section, water conditioning department, Allis-Chalmers Mfg. Co., points out that water—at least, the water provided by Nature—is not simply $H_2O$. He presents a general discussion of the subject of water treatment for cooling towers, with pertinent suggestions on selection and the results which can be expected*

those resulting from certain reactions promoted during the transfer of heat from a metallic surface to water flowing over this surface or in contact with this surface.

## Cooling System Problems

In the probable order of importance these are: (1) scale deposition or fouling; (2) corrosion of metal surfaces; (3) the formation of organic growths such as algae and bacterial slime.

In the case of fouling, a deposit of water origin adheres to the metal surfaces and because of its insulating qualities greatly reduces the efficiency of the exchanger. In a turbine condenser the obvious result is loss of vacuum and drop in turbine efficiency. Fouling of heat exchange surfaces in diesel engine operation causes over-heating. In either case, increased maintenance costs will result.

Corrosion of a surface condenser to the point of complete penetration leads to condensate contamination with its attending difficulties and, of course, loss of load. A similar situation in a diesel plant results in contamination of the water in the closed system followed by damage to the unit because of insufficient cooling caused by scale deposition.

In addition to forming insulating layers in themselves and aggravating fouling by combination with silt or calcium carbonate, organic slimes may promote corrosion by forming membranes for concentration cells and furnishing a source of corrosive gases such as ammonia during the process of bacterial metabolism.

Cooling water difficulties are recognized by a lower rate of heat exchange which is apparent from higher temperatures in the liquid being cooled or the requirement of a greater flow rate of cooling water in order to obtain the same degree of heat removal. In the operation of a turbine condenser the loss in vacuum or increase in absolute pressure within the condenser is an indication that the heat is being removed to a lesser extent than it was under previous conditions.

An increase in pump pressure on the circulating pump often also designates an increase in the resistance to the flow of circulating water through a condenser and this increased resistance is due to closing of the water passages by scale or corrosion products. An inferior quality condensate points toward contamination by cooling water often due to corrosion in part of the exchanger tubes.

**Table 1—Weight and volume comparisons of constituents in a condenser scale**

| Constituents | % Weight | % Volume in place |
|---|---|---|
| Calcium carbonate | 90 | 27 |
| Iron oxide | 5 | 2 |
| Magnesium hydroxide | 2 | 1 |
| Organic matter | 3 | 70 |

## Characteristics of Deposits

Condenser deposits may consist of one or two types comprising a combination of inorganic salts and biological growth. By far the most common inorganic compound found is calcium carbonate. This is identical to the mineral limestone. It is a case of limestone depositing out of water solution in the form in which it was originally present in the ground before water took it into solution. Ground water usually has some contact with limestone layers below the ground and surface water has contacted limestone lying on top of the ground. The dissolution of limestone is inevitable.

Inorganic deposits such as calcium carbonate are quite dense, whereas biological growths contribute porosity and volume to a deposit. Table 1 shows what relationship exists between the percent of a material and the volume which it occupies in place.

It will be seen that although the calcium carbonate is present in the greatest percentage by weight, it does not occupy nearly the volume that the hydrous biological slime occupies. Since the insulating layer depends upon both thickness and insulating characteristics of the material, it can be seen that biological slimes may be much more insulating than is at first supposed when only considering the relative percentages in which they exist on a weight basis.

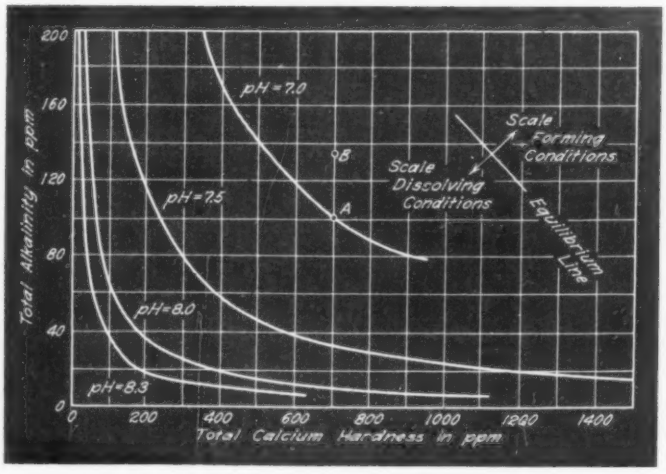
Iron oxide may be found as a major constituent of a deposit if the water contains soluble iron. Iron oxide usually is not as dense as calcium carbonate and also may be associated with silt. Water carrying an appreciable amount of suspended quartz or sand usually is self-scouring.

## Calcium Carbonate Is Troublesome

Calcium carbonate is by far the most troublesome deposit found in heat exchange systems where the temperature of the cooling water does not exceed 140 F or thereabouts.

The factors controlling the deposition or solution of calcium carbonate are very complex, but in general they depend mainly upon three: (1) the total calcium hard-

**Fig. 1—Equilibrium conditions for calcium carbonate at different pH values (77 F)**



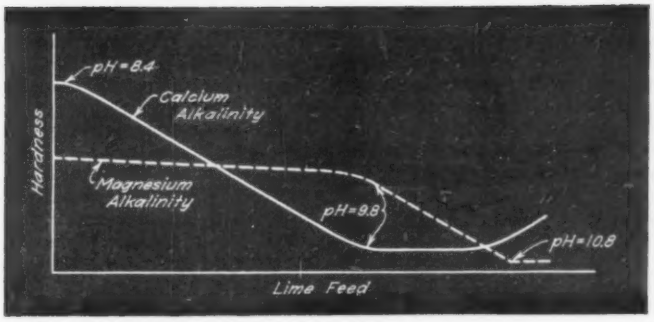



**Fig. 2—Softening of water by lime treatment**

ness; (2) the total alkalinity (methyl-orange); (3) the pH value.

Fig. 1 indicates the interdependence of these three relations at a temperature of 25 C. These curves represent equilibrium conditions for calcium carbonate involving the three above mentioned variables. For example, suppose we have a condition indicated by point *A* in which the total alkalinity of the water is 100, the calcium hardness is 700 and the pH value is 7.0. In this instance we find that it occupies a point exactly on the curve for pH 7.0. This means that no calcium carbonate will be precipitated from solution under those conditions.

Consider the case of another water in which the pH and the calcium hardness are the same as the first, namely 7.0 and 700, but the alkalinity is 130 as at point *B*. Point *B* is above and to the right of the curve and, therefore, the water conditions are in a scaling zone and calcium carbonate would be expected to precipitate out of solution. This water could be brought back to equilibrium in two different ways, either by reducing the hardness or by reducing the alkalinity and this is the reasoning one uses in correcting the scale forming circulating water to one which is not scale forming. In making use of the figure, therefore, one locates the point representing the two conditions of calcium hardness and alkalinity and observes whether it falls above and to the right of the pH curve (scale forming area) or whether it falls below and to the left of the curve (scale dissolving area). Fig. 1 must be used with considerable reservation, however, as it represents equilibrium conditions for a temperature of 25 C (77 F) only.

*Calcium Sulphate*—Calcium sulphate in the form of gypsum is sometimes found when the calcium sulphate concentration of the cooling water has been allowed to concentrate to too high a value. The solubility is close to 1500 ppm and this is very often set as a maximum permissible concentration in cooling towers. It is considerably more difficult to remove chemically than calcium carbonate for it is only slightly soluble in acid.

*Magnesium Silicate*—Magnesium silicate is very rarely found and requires considerable length of time for its formation. It is quite likely to be slimy in the first stages of formation but later re-crystallized into a more dense deposit upon aging.

*Biological Deposits*—Biological deposits are very complex combinations of various slime forming growths and bacteria. Generally it is not essential to know the exact species which are present in the water as the remedy is practically the same for all. The lethal dosages are different for each species, but since these are determined by trial and error in individual plants a prior knowledge of the species present may not be necessary.

## Control of Corrosion

The large volume of water used in condenser cooling magnifies the problem of completely controlling corrosion by chemical treatment. Therefore, the better approach is one of selecting materials of construction which possess sufficient resistance to corrosion.

Aqueous corrosion of iron and steel is an oxidation reaction involving the formation of iron oxides; hence, the problem is accentuated in recirculating systems which permit the cooling water to become saturated with oxygen. Further, the rate of attack is greater with waters of low pH. The combination is almost sure to spell trouble. If cooling towers are located in highly industrialized areas, the water may become even more corrosive due to the absorption of such atmospheric gases as sulphur dioxide and hydrogen sulphide.

Effective protection by chemical treatment requires care in selection of chemicals and a rigid control procedure. Further, the chemical balance to be maintained should be determined not only from the limitations presented by the water supply but also by the type of metals in the cycle.

In general, corrosion may be minimized by (1) depositing a film of calcium carbonate on the metal surface in controlled amounts; (2) removing corrosive gases such as sulphur dioxide, carbon dioxide, hydrogen sulphide, oxygen, etc., from the water; (3) using chemical inhibitors—or a combination of all three preventive measures.

## Scale Prevention Procedures

Scale preventive procedures fall into the following classes: (1) softening; (2) alkalinity reduction; (3) surface active treatment; (4) deconcentration; (5) sterilization.

### *Lime Softening*

Softening by lime is a very effective way of removing calcium bicarbonates from water. The calcium in the water and that added as lime are both precipitated from solution. Magnesium bicarbonate is also precipitated by lime but it is not necessary to remove the magnesium because it does not ordinarily form condenser deposits. As increments of lime are added to water, the pH value increases and the removal of carbon dioxide, calcium bicarbonate and magnesium bicarbonate take place in the order mentioned. This is shown graphically in Fig. 2. Up to pH 8.4, carbon dioxide is neutralized and precipitated. As more lime is added, the pH value rises between 8.4 and 9.8,

during which time calcium bicarbonate precipitates to the limit of its solubility. As more lime is added, magnesium begins to precipitate until a value of 10.8 is reached. After this, any further addition in lime increases the hardness due to excess calcium hydroxide remaining in solution. The water coming out of the lime softener, however, is still slightly super-saturated especially when no filters are used and in view of the fact that the temperature will be increased in passing through the condenser, this super-saturation is broken by adding some sulphuric acid just before the circulating pump. Sufficient acid is usually added to bring the pH value below 8.2.

*Zeolite Softening*

Zeolite softening reduces the calcium hardness to zero if such a degree of softening is desired, but it has no influence on the total alkalinity or the pH value. The alkalinity and pH, however, are of not too much concern since the calcium is zero, and there cannot be any deposits of calcium carbonate formed from the use of this water.

*Sulphuric Acid Treatment*

In certain instances a heat exchanger scaling problem can be alleviated by the use of sulphuric acid only without any softening. The use of sulphuric acid accomplishes a reduction in total alkalinity and this results in a neutralization of part of the calcium bicarbonate as well as a reduction in the pH value. This makes for a more stable condition and calcium bicarbonate has a greater tendency to remain in solution. In passing through the cooling tower, a great deal of aeration takes place and the pH value increases to the point where, on a second pass through the circulating pump, the water requires additional sulphuric acid. In practice, a continuous feed is employed.

*Surface Active Agents*

One of the most effective chemicals, pound for pound, in preventing the precipitation of calcium carbonate is the class of compounds known as surface active agents. This includes certain phosphorous compounds such as meta-phosphate, pyro-phosphate, tetra-phosphate and tri-phosphate. The manner of application is exceedingly simple in that it can be applied by dripping into the suction of the circulating pump as continuously as possible. The hardness, alkalinity and pH values are not affected by the small amounts of treatment which are required. When using the complex phosphates, the usual control is to feed that amount which is required to give in the order of two parts per million of the complex phosphate in the body of the cooling water proper.

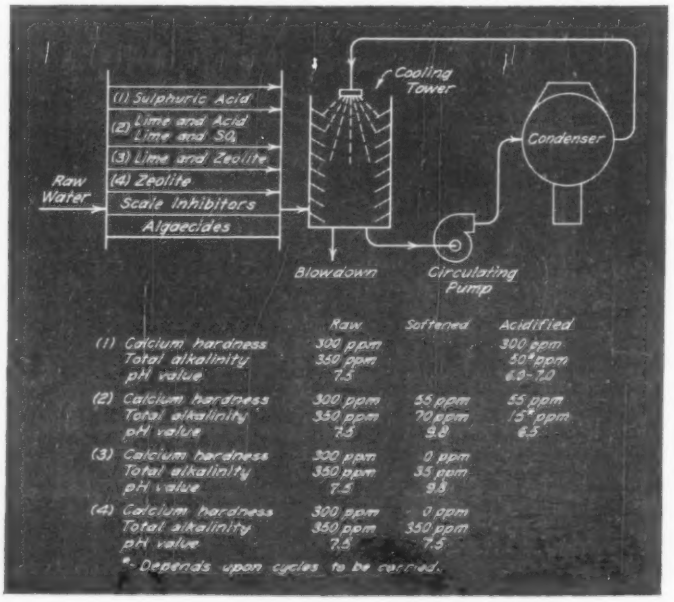
Certain organic compounds are also employed but usually in conjunction with the complex phosphates. The control, however, is usually based on the complex phosphate content only and the organic concentration is allowed to increase according to its ratio to the phosphate in the original mixture.

*Chlorination*

Biological growths can most easily be prevented by the use of biochemical poisons, the chief of which is chlorine. In the sterilization of water for domestic use, chlorine is applied continuously in small and controlled dosages. Here it is necessary to avoid excesses because of the taste which is imparted to the water and also for economy in sterilization. In chlorinating water for heat exchanger cooling purposes, it is not necessary to chlorinate continuously and in fact, there are good reasons why chlorination should be done intermittently. Effectiveness seems to be greater when chlorination is performed intermittently and it has been found that much less chlorine is used when fed in slugs. Moderately concentrated intermittent slugs are sufficient to kill biological growths after which they slough off the tube surfaces. New organisms then begin to grow until the next chlorination period kills them. Intermittent chlorination has the advantage of not permitting the organism to develop a tolerance for this poison and thereby smaller amounts are needed to be deadly.

The chlorination time, frequency and residuals carried during treatment differ according to the conditions with each individual plant and is arrived at by trial and error with local conditions. The chlorination period usually lasts from 2 to 20 min and the frequency may be as often as every 20 min to once every day and sometimes for even greater periods than once per day. The residual chlorine treatment also depends on the type of biological growths and the requirements are

**Fig. 3—Methods of cooling water treatment and the approximate results**




| | Raw | Softened | Acidified |
|---|---|---|---|
| (1) Calcium hardness | 300 ppm | | 300 ppm |
| Total alkalinity | 350 ppm | | 50* ppm |
| pH value | 7.5 | | 6.0-7.0 |
| (2) Calcium hardness | 300 ppm | 55 ppm | 55 ppm |
| Total alkalinity | 350 ppm | 70 ppm | 15* ppm |
| pH value | 7.5 | 9.8 | 6.5 |
| (3) Calcium hardness | 300 ppm | 0 ppm | |
| Total alkalinity | 350 ppm | 35 ppm | |
| pH value | 7.5 | 9.8 | |
| (4) Calcium hardness | 300 ppm | 0 ppm | |
| Total alkalinity | 350 ppm | 350 ppm | |
| pH value | 7.5 | 7.5 | |

*-Depends upon cycles to be carried.

**Table 2—Approximate limits for control of maximum concentrations in recirculating cooling water systems to prevent carbonate and sulphate scale**

| | Type 1 | Type 2 | Type 3 | Type 4 |
|---|---|---|---|---|
| Calcium hardness | 200 ppm | 1000 ppm | 600 ppm | 30 ppm |
| Total alkalinity | 200 ppm | 60 ppm | 600 ppm | — |
| Sulphate as ($SO_4$) | 1000 ppm | 1000 ppm | 1000 ppm | — |
| pH value | 7.1 | 6.9 | 7.6 | 8.7 |
| Complex phosphate | — | — | 2 to 3 | — |

between 1.0 and 5.0 parts per million.

There are also other chlorine compounds which are quite effective such as sodium pentachlorphenate. This is a solid material soluble in the water and has one advantage over gaseous chlorine in that none of it is dissipitated in passing through sprays in an aeration tower where water may be recirculated. The dosages of this latter compound usually recommended are 20 to 30 parts per million in the water passing through the condenser.

Fig. 3 graphically indicates the various methods of treatment and the approximate results.

### Control Procedures and Operating Range

Equally as important as making the proper selection of pretreating equipment is establishing satisfactory procedures and maintaining correct operating limits.

In addition to the control as regards the treating equipment for the make-up water, the operator must decide how many concentrations are safe in the cooling system before it is necessary to blowdown.

Obviously, some deconcentration is needed, for even if the water were completely softened the concentration of sodium salts might finally become great enough to scale out in the cooling systems. The allowable concentration for preventing carbonate scale depends upon the calcium hardness, the total alkalinity and the pH value (as illustrated in Fig. 1).

In recirculating systems in which calcium hardness is present it is also necessary to keep the sulphate content of the water in the system below 1000 ppm in order to avoid the formation of gypsum. The use of the blowdown will, therefore, be employed to maintain the above mentioned concentrations in a recirculating system. In view of the complex combination of factors affecting the cleanliness of condensers or heat exchange equipment, the permissible concentration of soluble solids is not determined until the system has become stabilized. If the quality of the raw water source is constant, the blowdown from the tower can be controlled by the comparison of the chloride readings in the raw water with those in the circulating water. Theory does, however, give some indication of approximate ranges to follow in deconcentration and Table 2 is presented with that thought in mind. It should be remembered that the limits given in the table are by no means absolute, but will indicate the proper order of magnitude from which to begin control according to the type of treatment used.

The recirculating cycles in the Type 1 include (a) untreated raw water and (b) lime softened and recarbonated water. Type 2 refers to those treating systems employing the use of sulphuric acid (or pH adjustment with $SO_2$ by burning sulphur) regardless of whether the acid (or the $SO_2$) is fed to (a) raw water or (b) lime softened water. Type 3 refers to those treating systems employing surface active agents which include complex phosphates. This type of treatment may be used on raw water, lime softened and recarbonated water and make-up water a part of which is zeolite treated. Limits on water which is entirely treated through a zeolite softener are listed under Type 4. The alkalinities, sulphates and chloride will all concentrate as sodium salts in this instance and require no special attention. The pH value and hardness do, however, require constant checking.

### Selection of Water Treatment

The selection of the treatment required by a water to be used for cooling purposes will be based on special consideration of the availability of water, the number of times it can be safely concentrated without scale deposition and the cost of such treatment. In order to recommend the proper type of treatment to be used, the control methods to be established and the operating limits to be maintained, the data in Table 3 should be available to the chemical engineer.

In addition to the data in Table 3 concerning conditions the chemical engineer should have the following information with respect to the water analysis: (a) calcium hardness; (b) total hardness; (c) total alkalinity; (d) pH value; (e) iron; (f) chlorides; (g) sulphates; (h) nitrates; (i) ammonia; (j) hydrogen sulphide.

**Table 3—Data needed for water treatment selection**

1. Type of system (open, recirculating or closed).....
2. Temperatures (F)
   Make-up water—Winter ..... Summer .....
   Circulating water—Entrance..... Exit ..... (Winter)
   Entrance..... Exit ..... (Summer)
   Temperature drop through tower ..... F
3. Type of tower
   1. Atmospheric .....
   2. Forced draft .....
   3. Induced draft .....
   4. Evaporative condenser or cooler .....
   5. Spray pond.....
4. Materials of construction
   Tower: Distribution system: Sump..... Pumps..... Sides.....
   Condensers or coils: Tubes..... Headers..... Piping.....
   Pumps.....
   Material being condensed or cooled.....
5. Quantities of flow
   Make-up: ..... gpm for..... hr/day
   ..... gpm for..... hr/day
   ..... gpm for..... hr/day
   Circulating water:
   ..... gpm for..... hr/day
   ..... gpm for..... hr/day
   ..... gpm for..... hr/day
6. Quantity of steam condensed..... if surface condenser.....
7. Circulating pumps
   Number: .....
   Capacity each: ..... gpm..... gpm..... gpm.....
   Number in use at one time: ..... for..... hr
   ..... for..... hr
   ..... for..... hr
8. Is plant in an industrial area where $SO_2$, $H_2S$ etc. might be absorbed by the cooling water?
9. Is the make-up softened ..... How.....
9. Is the make-up acidified ..... Type of acid used.....
   Amount.....

*Eiffel's*
*Logarithmic Vectors Solve*

# PIPING FLOW PROBLEMS

*W. R. BURROWS, assistant chief engineer, Whiting refinery, Standard Oil Co. (Indiana),* *described the general procedure of constructing charts with Eiffel's logarithmic vectors in his article in the March HPAC. The method is illustrated and amplified in this second and concluding article by using it to obtain a graphical solution of the specific problem of the steady flow of liquids in horizontal, completely filled, steel pipes. Calculations for the construction of this liquid flow chart are given in full, and the chart itself is suitably presented for engineering use. Sufficient information, details, examples, and suggestions are supplied to enable engineers to construct workable graphs of this type. Insofar as the author has been able to determine, this is the only presentation of Eiffel's logarithmic method in English*

IN HIS 81ST year, Alexandre Gustave Eiffel (builder of the spectacular tower in Paris bearing his name) published an exposition of his graphical method employing logarithmic vectors. This procedure appears to have escaped notice in this country, and it seems certain that if the method were better known to the American engineer, he would find it expedient and profitable to apply it either to new problems or to those now presented in a less convenient form.

The principles and construction of Eiffel's logarithmic vector charts were described rather completely in the March HPAC. Further amplification of the procedure will occur naturally in the process of applying it to the solution of the particular problem of liquid flow in pipe lines, which is treated this month.

## Liquid Flow in Piping

It is usually customary for refinery designers to assume that the friction factor for steadily flowing liquids in completely filled, round, horizontal, steel pipes is a simple function of $Dusz^{-1}$ similar to that shown in logarithmic coordinates in Fig. 8, where the local effects at the critical point between viscous and turbulent flow are purposely omitted, and where a practical minimum value of $f$ of about 0.0043 is arbitrarily established [see Principles of Chemical Engineering, by Walker, Lewis and McAdams; McGraw-Hill Book Co., New York City, 1st ed., 1927, p. 87]. More complicated representations [see Friction Factors for Pipe Flow, by Moody; ASME Transactions, vol. 66, 1944, p. 671] may, of course, be drawn to include different pipe materials, roughness of the inner surface, etc., but choice of this information will differ among designers. Since such data can be sketched in at will to suit individual requirements, without affecting the chart to be described, only $f$ in its simplest form will be shown.

Now this friction factor $f$ is related to the pressure drop $\Delta P$ through the well-known formula

$$f = D(\Delta P)(32.3\, su^2)^{-1} \quad \ldots\ldots\ [6]$$

The substitution of this and the preceding relationship into equations [2] and [3] results in

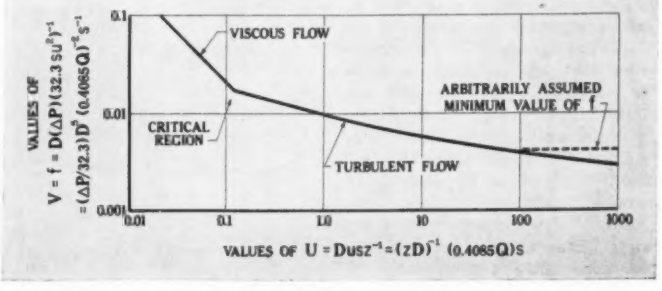
$$U = Dusz^{-1} \quad \ldots\ldots\ [7]$$

$$V = f = D(\Delta P)(32.3\, su^2)^{-1} \quad \ldots\ [8]$$

These expressions contain the velocity variable $u$ but not the flow rate variable $Q$.

The $u$ variable can be replaced by $Q$ in equations [7] and [8] through the substitution

Fig. 8—Friction factor curve simplified for design purposes



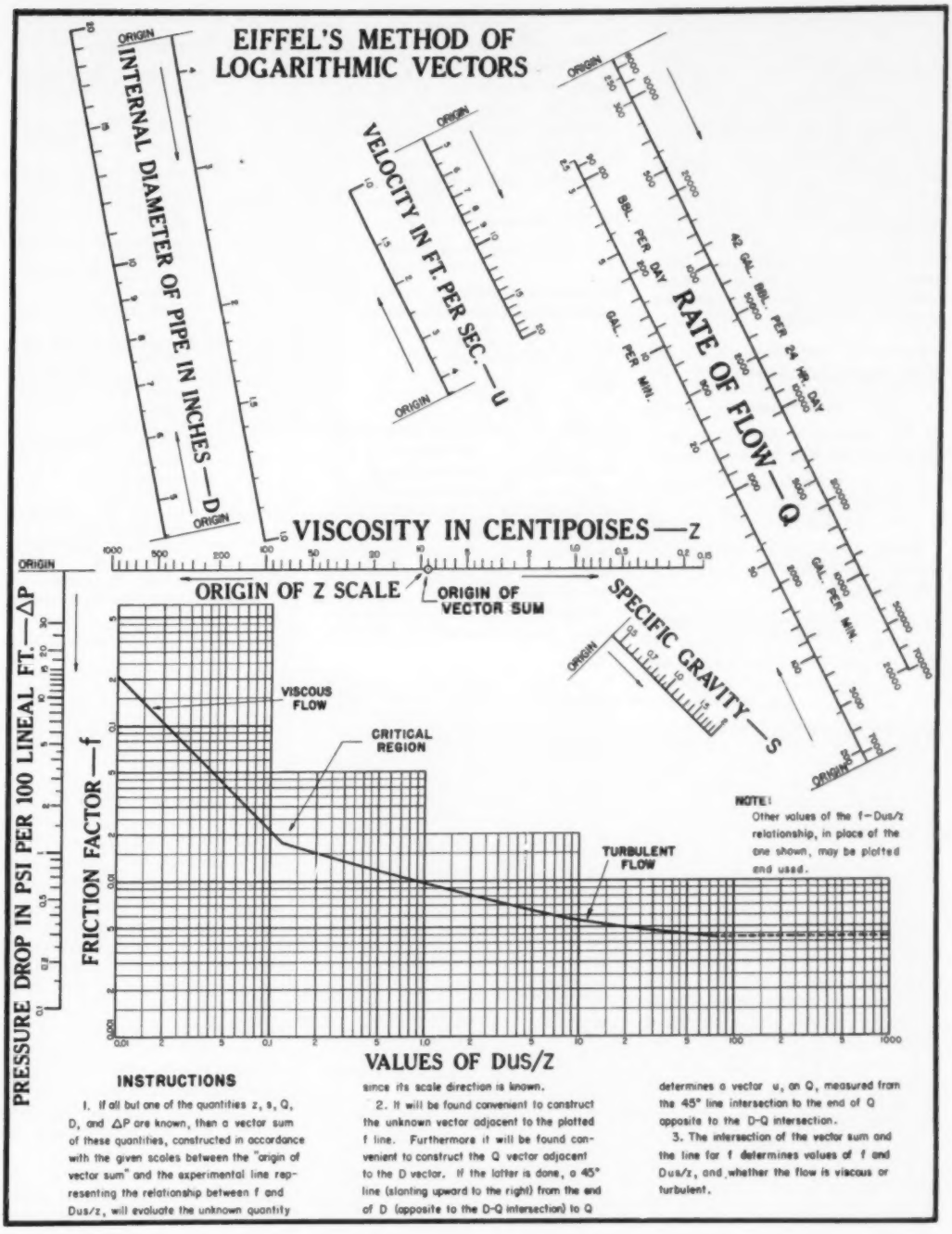

EIFFEL'S METHOD OF LOGARITHMIC VECTORS
INTERNAL DIAMETER OF PIPE IN INCHES—D
VELOCITY IN FT. PER SEC.—U
RATE OF FLOW—Q
42 GAL. BBL. PER 24 HR. DAY
BBL. PER DAY
GAL. PER MIN.
GAL. PER MIN.
VISCOSITY IN CENTIPOISES—Z
ORIGIN OF Z SCALE
ORIGIN OF VECTOR SUM
SPECIFIC GRAVITY—S
PRESSURE DROP IN PSI PER 100 LINEAL FT.—ΔP
FRICTION FACTOR—f
VISCOUS FLOW
CRITICAL REGION
TURBULENT FLOW
VALUES OF DUS/Z
NOTE: Other values of the f—Dus/z relationship, in place of the one shown, may be plotted and used.
INSTRUCTIONS
1. If all but one of the quantities z, s, Q, D, and ΔP are known, then a vector sum of these quantities, constructed in accordance with the given scales between the "origin of vector sum" and the experimental line representing the relationship between f and Dus/z, will evaluate the unknown quantity since its scale direction is known.
2. It will be found convenient to construct the unknown vector adjacent to the plotted f line. Furthermore it will be found convenient to construct the Q vector adjacent to the D vector. If the latter is done, a 45° line (slanting upward to the right) from the end of D (opposite to the D-Q intersection) to Q determines a vector u, on Q, measured from the 45° line intersection to the end of Q opposite to the D-Q intersection.
3. The intersection of the vector sum and the line for f determines values of f and Dus/z, and whether the flow is viscous or turbulent.

**Fig. 9—Vector chart for solving the problem of steady liquid flow in horizontal, completely filled, steel pipes**

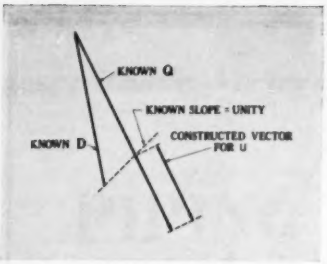



**Fig. 10—Construction of vector $u$ from known vectors for $D$ and $Q$ and from vector (alternate vector for $D$) with known slope of unity**

$$Du = D^{-1} Q\ (0.4085) \quad \ldots\ldots\ldots [9]$$

in the expression for $U$, and

$$Du^{-2} = D^{5} Q^{2}\ (0.4085)^{-2} \quad \ldots\ldots [10]$$

in the expression for $V$, so that Equations [2] and [3] now become

$$U = z^{-1} D^{-1} Q\ (0.4085) s \quad \ldots\ldots [11]$$

$$V = f = \Delta P\ (32.3)^{-1} D^{5} Q^{-2} (0.4085)^{-2} s^{-1} \quad \ldots\ldots\ldots [12]$$

When construction factors are added, Equations [11] and [12] take the form

$$U = (zK_1^{-1} K_2 K_3)^{-1} (DK_1)^{-1} \text{ times } Q\ (0.4085)\ K_2 (sK_3) \quad \ldots\ldots [13]$$

$$V = \Delta P (32.3)^{-1} (K_1^{-5} K_2^{2} K_3) \text{ times } (DK_1)^{5} Q^{-2}\ (0.4085\ K_2)^{-2} (sK_3)^{-1} \quad \ldots\ldots\ldots\ldots [14]$$

The velocity variable $u$ is now missing in Equations [13] and [14]. To obtain a vector scale for $u$, consistent with Equations [13] and [14], it is necessary that

$$(uK_4)\ (DK_5) = (DK_1)^{-1} Q\ (0.4085\ K_2) \quad \ldots [15]$$

for the expression $U$, and

$$(uK_4)^{-2} (DK_5) = (DK_1)^{5} Q^{-2}\ (0.4085 K_2)^{-2} \quad [16]$$

for the expression $V$. Then two simultaneous algebraic equations

$$K_4 K_5 = K_1^{-1} K_2$$
$$K_4^{-2} K_5 = K_1^{5} K_2^{-2}$$

yield

$$K_4 = K_1^{-2} K_2$$
$$K_5 = K_1$$

so that $K_4$ and $K_5$ are determined by $K_1$ and $K_2$. Subsequent to the establishment of values for $K_1$, $K_2$ and $K_3$, it will now be possible to accumulate all needed plotting data in Table 2. However, $K_5$ on line 9 of Table 2 will not be required, because it relates to a second and superfluous scale for $D$.

After some consideration, the following values have been assigned to the construction factors:

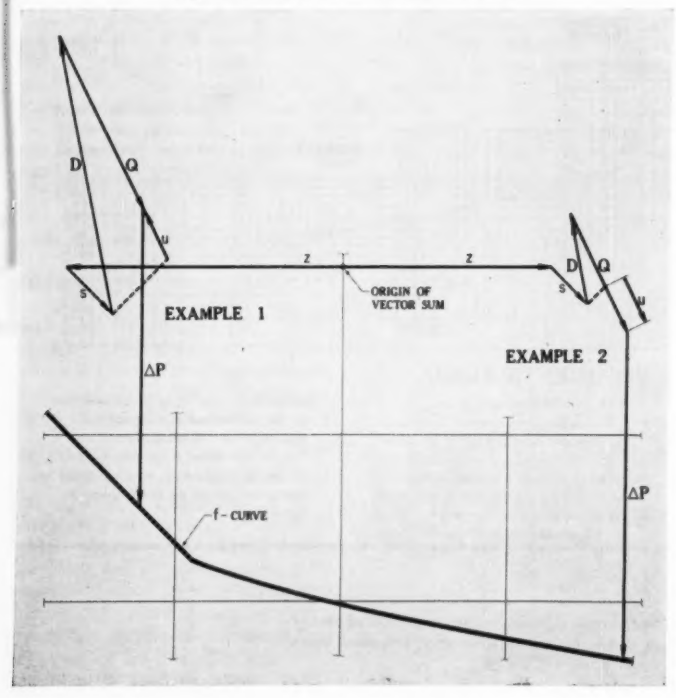
$$\text{Log } K_1 = -0.650$$
$$\text{Log } K_2 = -1.952$$
$$\text{Log } K_3 = 0.347, \text{ whence}$$
$$\text{Log } K_4 = -0.652$$

and, in order to preserve the familiar depiction of the friction factor shown in Fig. 8, without distortion, $n$ has been made equal to $m$.

The choice of these working factors appears to be satisfactory. A chart based on them is presented as Fig. 9. No claim, however, is made for superiority of organization of this chart. Others, constructing the same chart, might find a better arrangement; or a second or third trial might lead to improved results. But if such scale factors are assumed, Table 2 can be developed. It contains all data needed for the construction of Fig. 9.

It should be noted that, for consistency in this chart, the vector sum of $D$ and $Q$ (lines 5 and 6 of Table 2) must equal the vector sum of $u$ and $D$ (lines 8 and 9 of Table 2). Since the directions for all four vectors are known, it is necessary to plot only a single scale for $D$, the one shown on line 5 of Table 2.

**Fig. 11—Examples of determination of $\Delta P$**




## Nomenclature

$U$ = variable represented by scale on horizontal axis.
$V$ = variable represented by scale on vertical axis.
$W$ = variable represented by system of curves.
$Z_1, Z_2 \ldots$ = variable factors of $U$ and of $V$.
$a,b,c \ldots$ = exponents of variable factors of $U$.
$A,B,C \ldots$ = exponents of variable factors of $V$.
$D$ = inside diameter of pipe, in.
$\Delta P$ = pressure drop, psi per 100 ft.
$Q$ = flow rate, gpm (unless other units are indicated).
$f$ = friction factor.
$u$ = velocity of liquid flowing, fps.
$s$ = specific gravity of liquid flowing.
$z$ = viscosity of liquid flowing, centipoises.
$m,n$ = uniform or logarithmic scale factors.
$K_1, K_2, K_3 \ldots$ = construction factors.
Log = logarithm to the base 10.

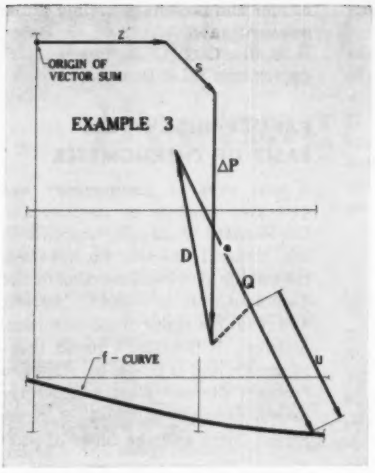



**Fig. 12—Example of determination of $Q$**

Now, by means of the three plotted scales for $D$, $Q$ and $u$ shown in Fig. 9, and with the knowledge that the slope of the omitted scale for $D$ is plus unity, the value of any one of the three variables $D$, $Q$ or $u$ can be obtained by construction if the other two are known. This procedure is indicated in the instructions of Fig. 9, is shown in Fig. 10, and is illustrated further in Figs. 11, 12 and 13. Briefly, this means that Fig. 9 is constructed for the consistent solution of the variables $\Delta P$, $z$, $s$, $D$ and $Q$. If $u$ is introduced, it must be consistent with $D$ and $Q$.

## Examples of Use of Flow Chart

Four examples are given to illustrate the use of Fig. 9.

*Example 1, Fig. 11*

Given: $Q$ = 25,000 42-gal bbl per 24 hr day; $D$ = 9.75 in.; $s$ = 0.85; $z$ = 450 centipoises.

Construction gives: $\Delta P$ = 1.0 psi per 100 ft; $u$ = 3.2 fps; $f$ = 0.036; flow is viscous.

*Example 2, Fig. 11*

Given: $Q$ = 500 gpm; $D$ = 5.761 in.; $s$ = 0.75; $z$ = 0.5 centipoises.

Construction gives: $\Delta P$ = 0.70 psi per 100 ft; $u$ = 6.2 fps; $f$ = 0.00445; flow is turbulent.

*Example 3, Fig. 12*

Given: $\Delta P$ = 2.0 psi per 100 ft; $D$ = 7.625 in.; $s$ = 0.9; $z$ = 1.5 centipoises.

Construction gives: $Q$ = 53,000 42-gal bbl per 24 hr day; $u$ = 10.9 fps; $f$ = 0.0045; flow is turbulent.

*Example 4, Fig. 13*

Given: $Q$ = 30,000 42-gal bbl per 24 hr day; $D$ = 6, 7, 8 in.; $s$ = 0.80; $z$ = 1.0 centipoise.

Construction gives, for $D$ = 6, 7, 8 in., respectively: $\Delta P$ = 1.95, 0.89, 0.46, respectively; $u$ = 10.0, 7.3, 5.6, respectively; flow is turbulent.

Use of the chart of Fig. 9 will soon show that it gives a clear idea of how changes in the values of the variables affect the solution. For example, if the vector assembly is shifted either to the right or to the left, the relative effect of viscosity changes is easily visualized, and quickly determined with exactness by construction.

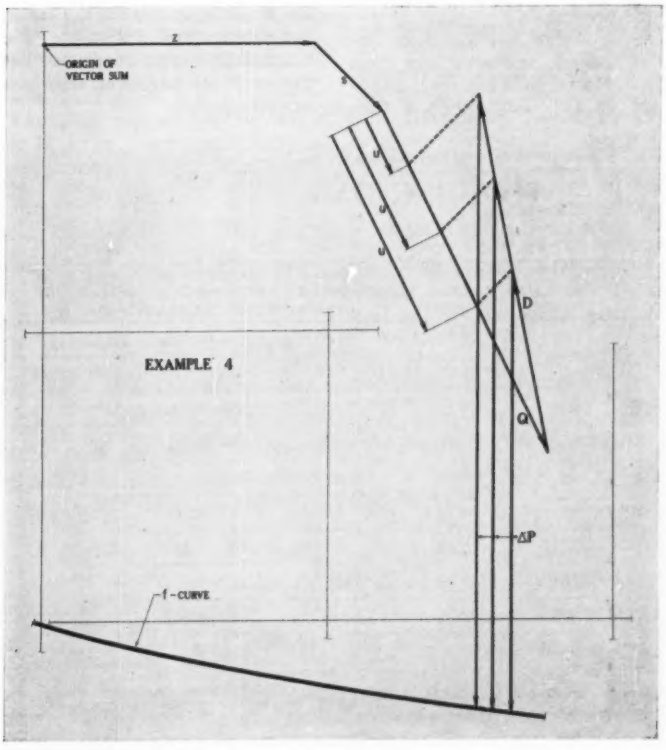



**Fig. 13—Example of study of $D$-$\Delta P$ relationship**

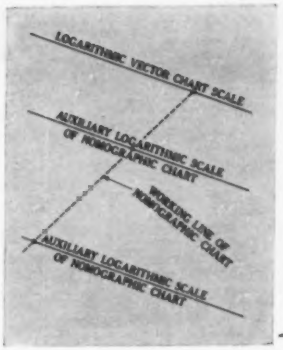

LOGARITHMIC VECTOR CHART SCALE
AUXILIARY LOGARITHMIC SCALE OF NOMOGRAPHIC CHART
WORKING LINE OF NOMOGRAPHIC CHART
AUXILIARY LOGARITHMIC SCALE OF NOMOGRAPHIC CHART

**Fig. 14—Logarithmic vector chart scale incorporated into nomographic chart with three parallel logarithmic scales**

## Eiffel's Solution Combined With Others

Combinations of this and other graphical solutions make the scheme more effective. For example, the vector scales are always logarithmic. Hence, if it is desirable to do so, it is possible to make anyone of them a part of an auxiliary nomographic chart. One way that this can be done is illustrated in Fig. 14, where the reading on the logarithmic vector scale, to be used in constructing the vector sum, is determined by a straight line passing through a point on each of two nomographic chart scales [The

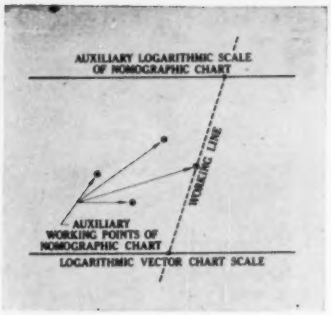

AUXILIARY LOGARITHMIC SCALE OF NOMOGRAPHIC CHART
WORKING LINE
AUXILIARY WORKING POINTS OF NOMOGRAPHIC CHART
LOGARITHMIC VECTOR CHART SCALE

**Fig. 15—Logarithmic vector chart scale incorporated into nomographic chart with two logarithmic scales and working points**

Nomogram, by Allcock and Jones; Sir Isaac Pitman and Sons, Ltd., London, 1932]. Schemes of this nature will become obvious to the chart constructor as he works.

Another possibility is to relate the viscosity scale in Fig. 9 to an auxiliary temperature scale through a number of points, one point for each liquid, in order to determine graphically the viscosity for a given temperature. McAdams [Heat Transmission, by McAdams; McGraw-Hill Book Co., New York City, 1st ed., 1933, p. 340, fig. 133] shows this procedure, which can be combined easily with the viscosity scale now incorporated in Fig. 9, as indicated in Fig. 15.

A third possibility is the use of as many parallel scales as needed to represent a single variable in a variety of different units. This is easily accomplished with logarithmic vector scales because, unlike nomographic construction, they do not depend on position but only on direction, sense and length.

### Many Other Applications

The application of the method of logarithmic vectors has been limited here to a single example, the flow of liquids in pipes, but its use can be extended to many problems in heat transfer, elasticity, etc. Wherever it is employed, it will serve to clarify visually the relationship among the variables. It is true that it is somewhat more cumbersome to operate than the familiar nomographic chart, because lines parallel to the scales must be drawn by some means such as two triangles or a drafting machine, and scale lengths must be transferred, usually by means of dividers. But the many advantages of the method seem to balance these few unfavorable features.

[The author is grateful for encouragement and assistance from D. A. Monro, chief engineer, Standard Oil Co. (Indiana), and from former and present personnel of the engineering division: G. O. Bates, J. R. Ramirez, C. J. Ryant, J. F. Eppler and W. J. Buxton.]

## RANQUE-HILSCH TUBE BASIS OF THERMOMETER

A NEW TYPE of thermometer was described recently by its inventor, Dr. Bernard Vonnegut, scientist of the General Electric Co. research laboratory at a joint meeting of the American Meteorological Society and the Institute of Aeronautical Sciences. It is called a vortex thermometer, and is in use on planes of "Project Cirrus," joint weather research program of the U. S. Army Signal Corps and the Office of Naval Research.

The instrument marks one of the first successful applications of the European-developed Ranque-Hilsch tube, widely known device which merely whirls air inside it to produce hot and cold air in two separate streams. Investigated by scientists in this country since the war, the tube has been found thus far to be too inefficient and uneconomical for such applications as heating and refrigeration, but its use in a temperature-taking instrument has proved highly successful, according to Dr. Vonnegut.

## TABLE 2—PLOTTING DATA

(FOR CHART SHOWN IN FIG. 9)

| LINE | VARIABLE | VARIABLE TO BE PLOTTED | HORIZONTAL AXIS EXPONENT | VERTICAL AXIS EXPONENT | SLOPE | SCALE CYCLE LENGTH | DIRECTION IN WHICH SCALE VALUES INCREASE | PRACTICAL RANGE OF VARIABLE |
|---|---|---|---|---|---|---|---|---|
| 1 | $U = Dus z^{-1}$ | LOG $Dus z^{-1}$ | m | 0 | 0 | m | RIGHT-HORIZ. | 0.01 TO 1000 |
| 2 | $V = f$ | LOG $f$ | 0 | n=m | ∞ | m | UP-VERT. | 0.001 TO 0.5 |
| 3 | $Z_1 = (z K_1^{-1} K_2 K_3^{-1})^{-1}$ | $-\text{LOG } z + 0.955$ | −m | 0 | 0 | m | LEFT-HORIZ. | 0.15 TO 1000 |
| 4 | $Z_2 = \Delta P (32.3)^{-1} K_1^{.5} K_2^{.5} K_3$ | LOG $\Delta P - 1.816$ | 0 | n=m | ∞ | m | UP-VERT. | 0.1 TO 20 |
| 5 | $Z_3 = DK_1$ | LOG $D - 0.650$ | −m | 5n=5m | −5 | $(26)^{0.5}$m | UP-LEFT | 1 TO 20 |
| 6 | $Z_4 = Q(0.4085)K_2$ | LOG $Q - 2.341$ | m | −2n = −2m | −2 | $(5)^{0.5}$m | DOWN-RIGHT | 2.5 TO 20000 |
| 7 | $Z_5 = sK_3$ | LOG $S + 0.347$ | m | −n=−m | −1 | $(2)^{0.5}$m | DOWN-RIGHT | 0.45 TO 2 |
| 8 | $Z_6 = uK_4$ | LOG $u - 0.652$ | m | −2n = −2m | −2 | $(5)^{0.5}$m | DOWN-RIGHT | 1 TO 20 |
| 9 | $Z_7 = DK_5$ ** | LOG $D - 0.650$ | m | n=m | 1 | $(2)^{0.5}$m | UP-RIGHT | 1 TO 20 |

** NO SCALE REQUIRED, $Z_7$ DUPLICATES $Z_3$

n=m, LOG $K_1$ = LOG $K_5$ = −0.650, LOG $K_2$ = −1.952, LOG $K_3$ = 0.347, LOG $K_4$ = −0.652

# Modern Church Has Radiant Heating, Air Conditioning

RADIANT HEATING, in conjunction with air conditioning, assures the congregation of the recently dedicated Church of Christ the King, Seattle, a pleasant and comfortable house of worship no matter how inclement the weather may be.

The new church, of modern architectural conception, stands on a hillside where it is fairly well exposed to the weather. The entrance faces south. While the climate is considered mild the year around, the design was based on 70 F indoors with an outdoor temperature of 10 F and a 15 mph wind.

### 6900 Ft of Steel Pipe

The entire building is of reinforced concrete, with a concrete slab floor and a 60 ft concrete bell tower. More than 6900 ft of steel pipe especially made for radiant heating is laid in all-welded coils in the floor. This floor is constructed of 4 in. of gravel, 1 in. of grout, a waterproof membrane of two layers of 30 lb felt, hot mopped down, an insulating slab of 4 in. vermiculite concrete on which the pipe is placed, and 3 in. of regular concrete.

A congregation of 550 persons can be seated in the semicircular nave of the building, not one of whom will be more than 50 ft from the altar. The entire church is radiant heated except for the lavatories and working sacristy, which are over the boiler room and heated with convectors rated at 22,000 Btu.

Total floor area is 7000 sq ft and there is an approximate air volume to be heated of 124,000 cu ft. There are, in all, four rooms—priest sacristy; working sacristy; crying, or mothers' room; and the nave, which has a choir pit located behind the altar and between the two sacristies. Over the choir pit is a fan room where the air conditioning system is located. This system can circulate 12,500 cfm outside or reheated air.

**The modern building of the Church of Christ the King, Seattle, which is heated by a radiant system. (Photos courtesy Bethlehem Steel Co.)**

Hot water for the radiant heating system is supplied by an oil burner operating on No. 5 Pacific oil. Mixing valves and controls are used throughout and each room has its own balancing valve and shutoff valve. The nave is divided into five wedge-shaped areas, each having four closures with their own balancing valves.

### Rated at 375,000 Btu per Hr

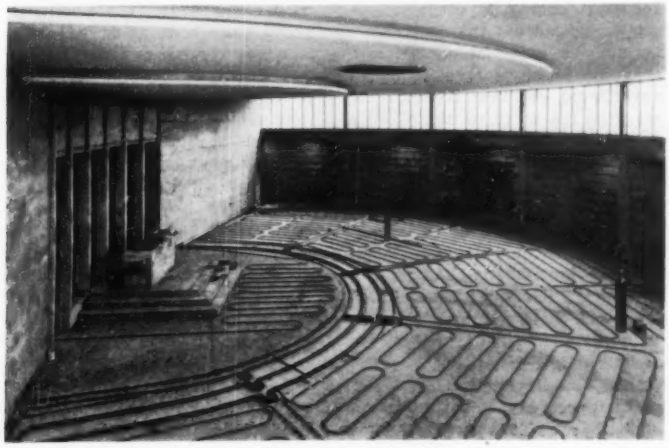
The shutoff valve for the nave is in the basement. Expansion strips separate each wedge-shaped section to take care of expansion and to insulate each section. All pipe mains have expansion loops wherever they cross expansion joints so that all expansion and contraction takes place in one place—along expansion joints. The entire radiation panel is rated at 375,000 Btu per hr.

Paul Thiry, Seattle, was the architect. The radiant heating system was installed by L. G. Massart Plumbing & Heating Co., Seattle. The Austin Co., Cleveland, were the engineers and general contractors.

* * * *

*You are invited to comment on any of the articles published in Heating, Piping & Air Conditioning this month. Our "Open for Discussion" pages are a regular editorial feature. Don't miss reading them.*

**Wedge-shaped grids of steel pipe in the floor of the nave of the church before pouring the concrete slab. Each panel has four closures with their own balancing valves. Expansion loops in the pipe mains are plainly visible in the picture**



*"UNHAPPY HUNTING GROUND"*

# Shooting Trouble in a Refrigeration System

*GEORGE HOLMAN, refrigeration service engineer and self-styled "free lance ammonia man," reports on operating difficulties with an industrial refrigeration system in a dairy, how he went about getting at the trouble in an afternoon spent at the "unhappy hunting ground"*

ONE DAY ONE of my former employers asked me to shoot trouble for him in an ammonia refrigeration system he had installed in a dairy plant. We left my place at high noon, and during our 40 mile drive to the "unhappy hunting ground" my companion gave me a brief outline of complaints given him by telephone and during a brief visit to the plant the day before.

A large ice builder sweetwater cooler wouldn't build ice on the pipes, the complaint ran. At the same time two large cooling and holding rooms on the same system had begun to warm up. A 6 in. by 6 in. ammonia compressor with cross line starting control would not start automatically, but had to be unloaded and started manually several times each day. Even then this compressor wouldn't run long unless a 5 in. by 5 in. compressor on the same system had been in operation for some time. To complicate matters, the 5 by 5 compressor had begun to short cycle. The two compressors could not be operated at the same time because, in the opinion of the plant superintendent and his chief engineer, the floor-set forced circulation evaporative condenser was too small to carry both units.

Before the plant had been tried out, my companion informed me, the servicing and maintenance of the refrigeration system had been taken from him and turned over to a service engineer in a nearby town. When the sweetwater cooler first failed to build ice, this man had installed a back pressure regulating valve in that branch of the vapor return pipe line leading from it.

"I can't figure out why," my companion said. "Back pressure regulators are made to keep things from getting too cold. They take the place of thermostats and pressurestats to put a floor under an evaporator when the compressor must keep on running on other evaporators. By putting that one where he did, he made absolutely sure that the sweetwater cooler would never build ice; that is, unless he set it so low as to be almost wide open.

"When this service mechanic couldn't get the unit to make ice," my companion explained further, "the manufacturer sent out an engineer. This man claimed at first that the system was short of ammonia. When 300 lb more of ammonia charged into the system didn't help matters any, he told the plant superintendent that I had installed the liquid receiver wrong, and not according to the prints. He said that as it was installed it wouldn't feed out enough liquid for the ice builder to work on. This company man set the back pressure valve wide open, which is the same as taking it out of the system. He also claims that I must reset the receiver according to the prints, or make the system work as it is."

### Sizing Up the Situation

At the plant, my companion promptly got into a heated discussion with the superintendent and chief engineer. I left him to their mercies, and began to size up the situation. The condenser fan and condensing water recirculating pump were both going full blast. But both compressors were idle.

A thermostat on the side of the ice builder, which opened the solenoid stop valve in the liquid line to the coils, resisted my efforts to trip it off, and promptly tripped the bulb back on the instant I released it. I could hear the valve snap open. While I was examining a row of switches, the third of three sweetwater pumps started up automatically. Condensate from the air had formed big drops of water on both outgoing and incoming branches of the uninsulated sweetwater circuit of 4 in. pipe.

I climbed to the top of the ice builder, took off a cover plate and

watched the agitator whirl the water in its swift, rolling circuit. By my pocket thermometer the water temperature was 46 F. There was no trace of ice on the pipes. There couldn't be.

After checking the back pressure regulator to make sure it was wide open, I closed and reopened the return line stop valve and the two liquid stop valves isolating the solenoid stop valve and its scale trap. There was a possibility of refrigerant stoppage at these points, as well as at the port of the solenoid valve, in the scale trap and at the port of the float regulated expansion valve located in the head of the surge tank atop the ice builder.

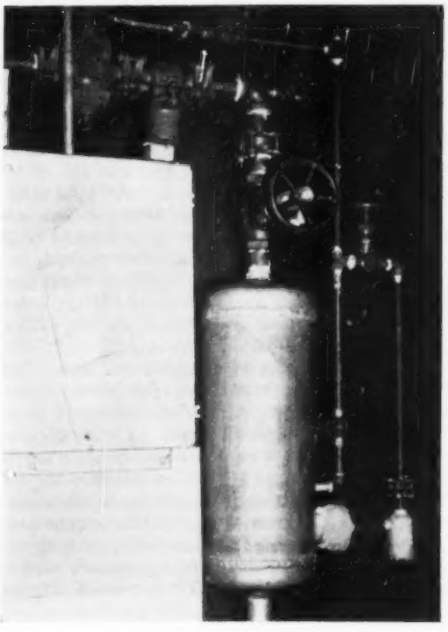
Once in my service experience with refrigeration equipment I had seen the head of one of these vessels turned halfway around by mistake, thereby putting the float regulated expansion valve upside down. Instead of closing when the liquid level rose to its proper place, it had remained closed until a bypass expansion valve permitted the liquid to reach the ball. Then it opened wider and wider, flooding the compressor even after the bypass expansion valve had been tightly closed.

This surge tank head, however, was properly installed, if the lettering on the iron was to be believed. I did not at this time check on stoppage at the strainer, solenoid valve orifice and float valve orifice. My companion had brought along an oversize seat for the expansion valve, and this last could be looked into when we pumped down the ice builder coils for the change.

The 5 by 5 compressor, controlled by pressurestats on both high and low sides, started up. I went down the ladder to the floor, and checked the starting pressures of the on cycle. The suction pressure stood at 70 psig, and the discharge pressure at 175 psig. The suction pressure fell slowly and became constant at 37 psig. The discharge pressure rose rapidly to 205 psig, then slowed to a hardly perceptible upward creep.

In answer to my questions, the chief engineer told me that those pressures had become common during recent weeks. "Ever since the company man set the back pressure valve wide open," he said. "Before that we kept the suction pressure around 15 lb, and sometimes it went down below zero of the gage. At that time the head pressure never went up to 200. We run the 5 by 5 day and night, and we could use the 6 by 6, too. I say the back pressure regulator should be put back into service."

**Piping connections for one of the forced circulation evaporators (with automatic defrost) installed in the cooling rooms. The back pressure regulator is above the evaporator, and the expansion float and scale trap are to the right of the accumulator**



"But did you build ice with it in service?" I asked.

"No," the chief engineer admitted. "But at least we could operate. That's more than we're doing now."

At this point, the 5 by 5 compressor stopped. The suction pressure still stood at 37 psig. The discharge pressure, however, had reached 220 psig. Without looking, I knew that the high side pressurestat had shut off the compressor on safety.

### "Ever Try Purging?"

"Ever try purging?" I asked. "You've got air in that system. Lots of air. At least 50 lb."

"We purge a little every day," the engineer said, and pointed out a gallon can of ammonia water.

"How do you expect to make ice at 37 lb suction?" I asked. "Roughly, that corresponds to an evaporating temperature of 23 deg. How do you expect to build ice, or even cool water, with only a 9 deg difference in temperature?"

"I don't," he said. "Not since that company engineer put the back pressure regulator out of service. It kept the pressure at 15 lb, and we had a 50 deg difference."

"Not in the ice builder," I pointed out. "The temperature difference there would be even less."

I looked the condenser over for possible dirty tubes, excessive slippage of recirculated water at the pump, and short circuiting of the air from the fan, any one of which would account, in part, for the high head pressure. The condenser was in an excellent state of repair, however. Whereupon I hunted up a 5 gal bucket, filled it with water from the condenser pan, and began purging into it through a length of pipe screwed into the purge outlet.

Even with the water tumbling over rapidly, and some ammonia escaping into the air, I had to use five buckets of water and more than an hour of the afternoon before I got the pressure low enough to keep the high side pressurestat from stopping the compressor. It was plain that my purging methods had to be improved.

My companion suggested using a hose, and blowing the ammonia-laden air out the window. No hose was available, however, and a 20 ft length of ½ in. pipe was substituted. We ran it out an open window, and ended it with an ell and long nipple to give the foul gases a proper start downwind. My companion agreed to hold the pipe end to prevent backlash and be on the lookout for neighbors in the nearby residential district who might take offense at the fumes. In case they came at us with weapons, we might have to take to the tall timber.

Each time I opened the purge valve the foul gases would blow for a little while. Then as the vapor pressure in the overcharged system fell, liquid ammonia would boil up and a blue streak would go blazing from the end of the purge pipe. This required opening and closing the purge valve dozens of times, and I must have blown away a hundred pounds of ammonia. But it did the trick. By and by the condenser pressure fell to 165 psig, and the temperature of the condensing water by comparison told me the system had been thoroughly cleansed of air.

With continuous operation and increased efficiency of the compressor at the lower discharge pressure, the suction pressure had pumped down to nearly 30 psig. But there it stayed. Although the sweetwater temperature had fallen 6 deg to 40 F, no ice had begun to form on the ice builder pipes. The cooling rooms had cut off by thermostats, thereby accounting in part for the 6 psig pressure drop of the suction gage. From these conditions it was evident that to build ice the sweetwater cooler required more ammonia circulation than the 5 in. by 5 in. compressor could produce. Failure of the compressor to pump down the cooler also showed that the solenoid stop valve was open, the scale trap passing ample liquid and the float regulated expansion valve in no need of the larger orifice seat my companion had brought along.

I tried out the 6 by 6 compressor. At the 30 psig suction pressure the current surge would kick out the overload relay of the cross the line automatic starter. Whereupon I closed the suction valve of the manifold, started manually, then gradually opened the suction valve to full load. With both compressors operating, the suction pressure came down rapidly to 17 psig, and leveled off there. This made another point clear to me: Both compressors would be needed to carry the icebuilder at full load.

By trial and error, I found that the 6 by 6 compressor would start automatically and continue to run at suction pressures up to 28 psig. After some discussion with the plant superintendent and engineer, both of whom wanted only the 5 by 5 compressor to run at night when no engineer was on the job, I set the pressurestats of this machine to cut in at 20 psig and out at 10 psig, and those of the 6 by 6 compressor to cut in at 25 psig and out at 15 psig. This setting would keep the smaller compressor running almost continuously, but would require operation on the larger compressor only during the day shift's heavy loads.

Before 5:00 p.m. a half inch of ice had formed on the pipes of the sweetwater cooler, and the 6 by 6 compressor began its first off cycle of five minutes. This off cycle would become longer and longer as the ice built up to its maximum thickness, I knew. And as the compressor started and came safely up to speed under load, my companion and I made a careful inspection of the plant, and headed for home.

## Heating Fuel Saved by Recovering Waste Heat from Air Compressors

RECOVERY OF waste heat from air compressors and their driving engines at the plant of Schramm, Inc., West Chester, Pa., is resulting in definite savings. Three compressors, two of them driven by diesels and the third by a spark ignition engine using manufactured gas fuel, deliver about 400,000 Btu per hr into a system for space or process heating.

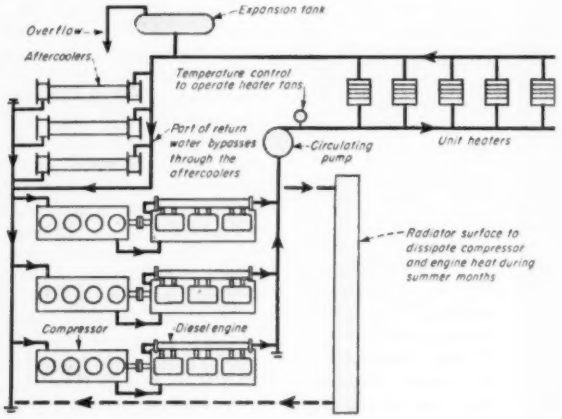
In a report by J. L. Michener, plant engineer, the system for recovering lost heat is explained. The engine compressors are teamed with unit heaters. The engines are equipped with marine type, water cooled manifolds. Water coming off the engine jackets thus picks up heat that would otherwise be exhausted to the atmosphere and wasted. Water is taken directly from the discharge of the engine-compressor cooling system and is circulated by a centrifugal pump through the heating equipment.

Certain controls are necessary. There should be a control in the hookup to keep unit heater fans from operating until water reaches a preset minimum temperature. This prevents blowing cold air.

For heat dissipation in the summer months, the water can be circulated just as before, but the unit heater fans are changed to discharge outside the building.

In a case such as this one, the cost of equipment and piping necessary to recover heat and put it to work is relatively small and the scheme results in real dollar savings.

**Heat recovery system for utilizing in unit heaters heat from the water cooling engines driving air compressors**



# Sam Lewis' Page

*INFORMAL comment on heating, piping, and air conditioning matters is given in this regular feature by Samuel R. Lewis, consulting mechanical engineer, and member of HPAC's board of consulting and contributing editors*

## Induced Vacuum Cause of Heating System Freeze-Up

INDUCED VACUUM is often a source of trouble in low pressure steam heating systems. A recent costly freeze-up in the tempering convectors of a large indirect heating system brought this forcibly to my attention.

The air supply fan was shut down but the outside air intake dampers, arranged for closure by power, were of the louver type and inherently not airtight; a strong wind pressure from outside forced subzero air through them against the convectors.

The steam supply to the convectors, controlled by a thermostat in the warmed air duct, was throttled. The return from each convector section was by way of a float trap and a thermostatic trap in parallel. The return main leading to the vacuum pump was higher in elevation than the bottom of the convectors, the designer's idea being that steam pressure in the supply pipe to each section of convector, plus the subatmospheric pressure in the return main, would induce such perfect drainage that no freeze damage could occur.

The plant did operate for sometime without freezing. However, the thermostat eventually did close the steam supply valve. The outside air, at about 20 below zero, did freeze and burst the alleged freeze-proof convectors. Evidently, induced vacuum caused by condensation of steam inside a sealed vessel became more potent than the mechanical vacuum induced by the pump in the rather distant boiler room. Thus, enough condensate was retained in the tubes of the convector, near their bottom ends, to freeze and to burst them. The accident might have been avoided if the return main had been lower in elevation than the bottom of the convectors, but there should have been some additional protection.

### Check Valve Equalizes Pressures

One such protective device is a third passage between the return outlet from the convector and the return main, placed in parallel with the thermostatic air trap and the float type water trap. In this third passage there is a horizontal swing check valve, opening toward the convector. Then, when steam is shut off and when the vacuum induced by condensation ensues, the check valve will permit equalization of pressure between that in the return main and that in the convector, so that water may flow out of the convector through the float trap regardless of the locally induced vacuum.

I remember a vacuum pump of many years ago that had an air-tight tank with an outward-opening check valve. All return mains led to this tank. Following the accumulation of some condensate, a float in the tank would permit entry of a cold water spray, and instantly the induced vacuum caused by condensation would drag the water from the various heat transfer apparatuses. During a second cycle of operation, the water in the tank would be transferred into the boiler and the air could escape. The scheme was abandoned after a few seasons of operation because the solids from the untreated cold spray water were deposited on the interior of the tank and clogged the float mechanism.

### Connecting a Condensate Pump

We are frequently queried about how to connect a condensate pump in a low pressure steam heating system. It is obvious that the steam pressure plus the hydrostatic head in the return main must exceed atmospheric pressure if the heat transfer devices are to work. The receiver of the condensate pump must be vented freely to the atmosphere, so as to get rid of the air that must enter with the condensate.

It is desirable also that, if all return mains are not at an elevation sufficiently higher than the receiver so as to drain into it by gravity, there be means such as an automatic air valve at every heat transfer device to eliminate the air locally. There have been many cases brought to my attention where low pressure steam heating systems failed because the designer thought he could eliminate such automatic air valves.

There are also cases of corrosion of return piping that could have been avoided by adequate air venting in steam heating systems that depend on condensate pumps.

## HIGH FREQUENCY SOUND FOR INDUSTRIAL CLEANING

HIGH FREQUENCY sounds can strip grease from metal in a matter of seconds, according to Dr. Robert O. Fehr, General Electric engineer.

Speaking before a meeting of the Albany Society of Engineers, he said that ultrasonics, sounds pitched too high to be heard by the human ear, can be extremely useful to industry, particularly in tedious cleaning operations.

# PRACTICAL VENTILATING PROBLEMS By Robert C. Soronen

ROBERT C. SORONEN, engineer specializing in the design and supervision of heating, ventilating, air conditioning, industrial exhaust systems, process piping, and drying installations, gives some practical suggestions here—based on his wide experience—on the design and application of kitchen range hoods.

## DESIGNING KITCHEN RANGE HOODS

RANGE HOODS play an essential and important role in kitchen exhaust ventilation systems, or in restaurant and dining room ventilation whenever these areas are adjacent to and in conjunction with the kitchen.

If the kitchen is remote from the dining area, makeup for the exhaust ventilation may be introduced either by mechanical means supplying tempered air, or air may be drawn into the kitchen from adjacent rooms through filter panels installed in the partition.

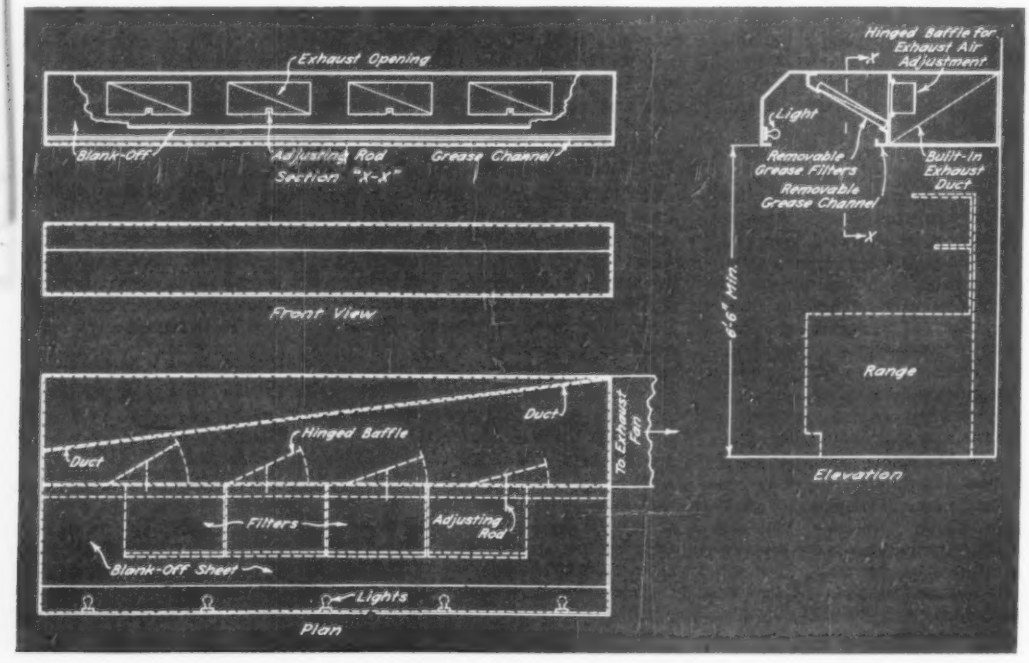
Whenever the kitchen and dining room are adjacent and separated only by a partition, air exhausted through the range hood should be equal to the computed exhaust volume for the dining room heating and ventilating or air conditioning system, if the computed volume is sufficient to provide effective range hood velocities.

### Volume of Air To Exhaust

The determining factors governing the volume of air to be exhausted are in turn dependent upon city or state codes or accepted standards of ventilation. These standards of ventilation may be based on occupancy at 15 sq ft of dining room floor area per person and air delivery at 30 cfm per person, or on an air change method ranging from a minimum of six to a maximum of 60 changes per hour. Some state laws or codes regulating the amount of ventilation air permit this volume to be computed on either the occupancy or the minimum air change basis. When this is true, the larger of these quantities should govern.

As an example, consider a restaurant 100 ft by 48 ft by 12 ft, equal to 57,600 cu ft of volume. Using an allowable floor space of 15 sq ft per person, we have a total of 320 people.

**Fig. 1—Large range and oven hood design adaptable both to extended coverage of equipment and limited ceiling height**



Basing the ventilation air on 30 cfm per person, a minimum of 9600 cfm must be introduced; whereas, using a minimum of six air changes per hour, the ventilation rate would be 5760 cfm. The larger of these quantities, 9600 cfm, would govern.

Proportioning the total ventilation air quantity to one-third outside air and two-thirds recirculated air, exhaust air through the kitchen and range hood would equal 3200 cfm. Assume that the kitchen in this example is 48 ft by 16 2/3 ft by 12 ft ceiling height, equalling a volume of 9600 cu ft. Air exhausted at a rate of 3200 cfm would provide 20 air changes per hour in the kitchen, which would be satisfactory.

Next, the area of kitchen range, ovens or other heat producing equipment and appliances which must be hooded, is determined. For the purpose of this example, assume that a hood having an area of 50 sq ft is required. As a means of checking, 60 cfm per sq ft of range hood face area is a sufficient quantity to promote effective exhaust. A range area of 50 sq ft and exhaust at a rate of 3200 cfm equals 64 cfm per sq ft of range hood.

Problems in actual practice generally will not work out to the almost perfect proportioning of one-third outside air and two-thirds recirculated air presented in this example.

Consider a kitchen having identical measurements, but requiring a hood equal to 80 sq ft of surface. An area of 80 sq ft and 60 cfm exhaust per sq ft would require 4800 cfm total exhaust. This volume would adjust the total air quantity of 9600 cfm to one-half or 50 percent outside air and an equal amount of recirculated dining room air.

### Determining Grille or Filter Areas

At this stage, we have arrived at the total quantity of air to be introduced into the dining room, the amount of recirculation and volume of outside air, which consequently is the rate of exhaust through the range hood. Knowing the amount of exhaust and the area of the range hood, we now must determine the grille area to be installed in the dividing partition between the kitchen and dining room when they are adjacent, or the area of filter panels to be installed in the kitchen partition in the case of a remote location.

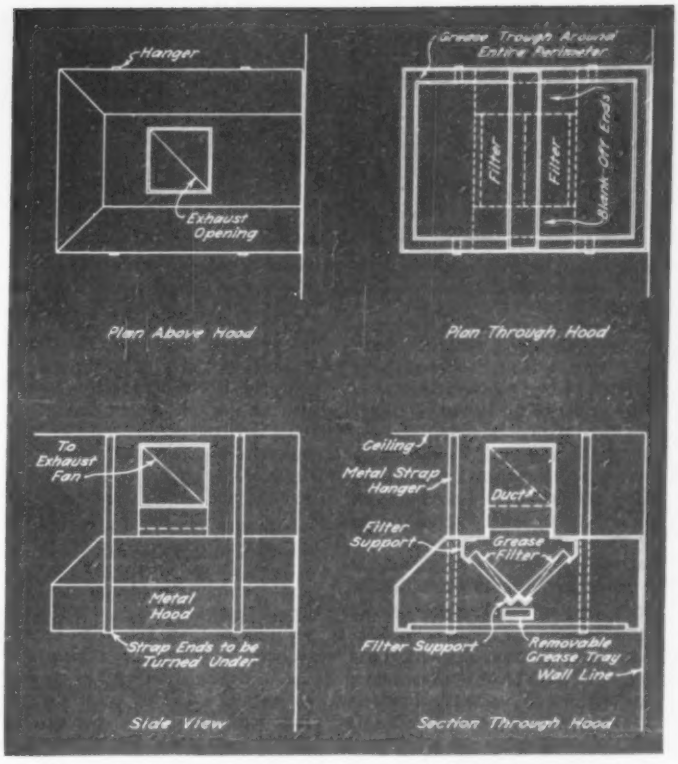



**Fig. 2—Single range hood design for a small short-order restaurant**

Location of grilles or filter panels is not of exacting importance, in my experience, and they may be installed wherever space conditions permit providing they are unobstructed. The transfer grilles may be selected on the basis of 400 to 600 fpm velocity through the net free area. Filter selection should be according to the manufacturer's recommendations and is usually based on a velocity of 300 fpm for the throwaway type.

We are now ready to select the proper design of the range hood. The purpose of the hood is to capture vapors containing grease and moisture (also cooking odors), filter the grease from the vapors, and discharge the objectionable odors and moisture laden vapors to the atmosphere by means of mechanical blowers or exhausters.

Design of the hood shape and its overall height is regulated by the available clear height from floor to ceiling, equipment layout, and the owner's likes or dislikes with respect to exposed or concealed ductwork. The height from the floor to the bottom face of the hood should be a minimum of 78 in., which is practical when people work underneath and also increases the effectiveness. The hood should overlap the range or other equipment 6 to 12 in. at the front and ends (12 in. preferably).

### Types of Range Hoods

Fig. 1 illustrates a hood design I have used which is adaptable both to extended coverage of equipment and limited ceiling height. The exhaust duct is built into the rear portion of the hood and, due to the fact that the air must be exhausted from the end, hinged adjustable baffles are provided to permit regulation of exhaust proportionately over the hood length and to eliminate concentrated air flow from the hood area nearest the exhaust outlet connection to the hood.

Filters are installed as indicated

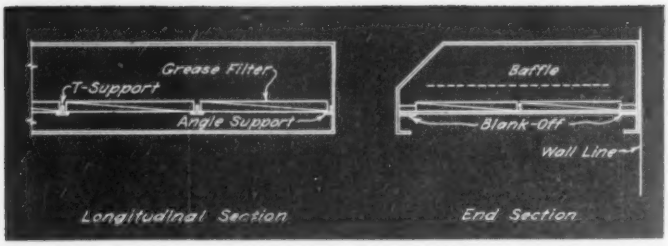



**Fig. 3—Hood for both single or large size ranges, similar to that of Fig. 2 but with a different filter arrangement and with no grease trough, as the filters are horizontal**

on shop fabricated supports, bent to the required angle necessary to accomodate the selected filter size. A removable grease trough or channel, also shop fabricated, is installed the full hood length. The purpose of the grease trough is to collect condensed grease which has not sufficiently cooled to adhere to the filters. The design allows ample space at the inner front of the hood to install lights if they are desired.

The type of hood sketched in Fig. 2 is preferred for the single range usually installed in the small short-order restaurant. Due to the small size, only one central outlet is needed connecting to an exhaust duct located directly above the hood, or located above the finished ceiling if conditions permit, terminating at a fan in any direction from the hood. Note that the hood has a continuous grease trough around the perimeter which is integral in addition to the removable tray directly below the filters.

A hood of the type shown in Fig. 3 can be used for both single or large size ranges; it is similar to the hood illustrated in Fig. 2. The difference is in the method of filter arrangement, plus the omission of a grease trough which would not serve any useful purpose with filters in a horizontal position. Filters are supported on lightweight structural tees and angles, or the supports can be fabricated from heavy gage, black iron, sheet metal.

Space not taken up by the filters should be blanked off with sheet metal.

The exhaust outlet to the fan suction, or multiple outlets in the case of large hoods, will connect to the top of the hood. This feature prohibits the use of this style of hood where low ceiling heights are encountered, unless space is available in a ceiling or attic area above. Multiple exhaust outlets must be provided on large hoods to distribute the suction evenly and effectively over the entire hood face, and eliminate concentrated suction which would otherwise occur if only one exhaust outlet were installed.

If physical conditions prevent the use of multiple outlets, or, if for some other reason the outlets cannot be evenly spaced over the hood length, provision of a baffle sheet as indicated in Fig. 3 is recommended. The baffle sheet should be installed above the filters, spaced to provide a slot at the front and rear with a velocity through the slot ranging from 600 to 1000 fpm.

With respect to all types of range hoods, filters should be of an approved type for kitchen range hood installation. They are rated on a square inch basis, usually 1½ to 2 cfm per sq in. of face area.

Exhaust ducts from the hood should be independent structures, also independent of any other exhaust system, and should lead to the outdoors as directly as possible with the outlet to the atmosphere arranged not to discharge near unprotected combustible material. Ducts should be constructed in accordance with the rules and regulations set forth by the National Board of Fire Underwriters.

### Exhaust Ducts from Hoods

Manual dampers in the exhaust duct are not recommended except that automatic shutters are permissible when mounted on the fan discharge, when the fan is installed on the roof, to prevent backdrafts when the fan is not in operation.

An accessible fusible link fire damper should be installed in the main exhaust duct near the hood as indicated in Fig. 4 to protect the fan, and another damper should also be installed in the discharge duct to prevent flame travel up through the duct. If the fan is installed above the hood, only one fire damper need be installed.

When range hoods and their exhaust ducts are installed adjacent to unprotected combustible building materials, a minimum clearance of 18 in. must be provided or they should be insulated in an accepted manner.

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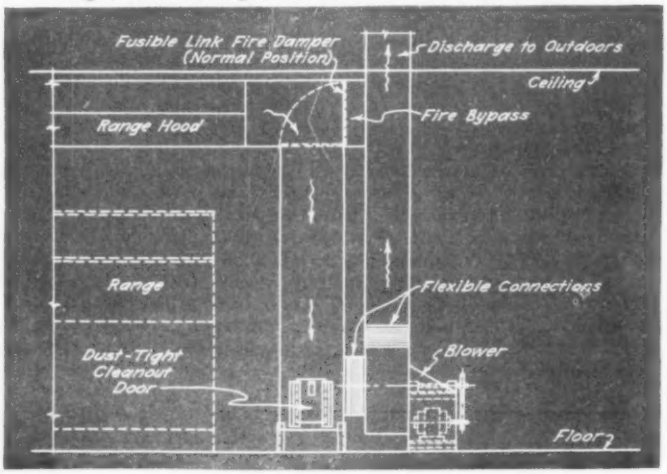
*For information about new products and improved ones, see the Equipment Developments columns in HPAC every month.*

**Fig. 4—Detail of range hood exhauster installed adjacent to hood**



# QUESTION of the Month

## What's Method of Piping for Oil Burner Systems?

IN A QUESTION published in the March HPAC, "S.G." asked about the accepted practice in industrial and commercial oil burner installations of bringing the oil from the tank to the burner. "Is it a two pipe system, using one suction feed line to the burner and a return line to allow the unburned oil to return to the tank?" he asked. He also wanted to know if a one pipe system (suction pipe only with no return) feeding a smaller amount of oil is ever used, and asked about the objections to and advantages of such a system.

About the only hookup of an industrial burner with a one pipe feed from the tank to the burner would be a small process oven or furnace using light oil. All other conventional burners and burner systems employing heavy or even medium grades of fuel oil utilize two pipe hookups between the fuel storage and the pump. The reason lies in the nature of fuel oil pumps, flow regulators and related burner accessories.

Practically all fuel oil pumps run at constant speed and hence deliver a constant discharge. The amount of fuel needed for the fire is diverted, or metered, from this discharge, and the remainder returns to storage. In some single pipe systems, using light oils, the surplus may bypass back into the suction line at the burner, but such practice characterizes small domestic burners rather than true commercial and industrial burners. One pipe systems can be used only where the tank level is higher than the burner with gravity feed, so as to maintain a hydrostatic head on the pump. If the pump must develop a suction lift, then a one pipe system will not work, because the pump soon becomes vapor locked, and ceases to move liquid. And since gravity feed is permitted only from a 275 gal tank, or smaller, obviously this hookup is restricted to small applications burning light grades of oil.

Most commercial burners operate with variable flame regulation, implying that the amount of oil burned is not constant. Since there is no feasible method of varying the pump discharge to suit the exact momentary requirement, the pump always circulates a stream of oil back to storage. Some burners employ a second pump to draw oil from the circulating stream, or from a reservoir at the burner, for controlling flow to the atomizer. Some systems employ remote pumps, with supply and return lines between pump and tank, and use a single line to convey oil from the pump discharge to the burner.

Thus far we have considered only the application of unheated fuels. If heavier, preheated, fuel oils are used, then the piping system assumes much further complexity, with additional circuits, flow regulators and pressure relief valves.

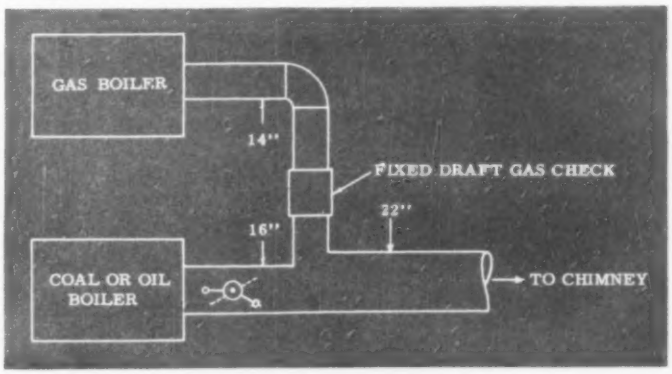
An appropriate reply to the question would require knowledge of many other factors: the application, capacity and type of burner; grade of oil to be burned; style of control desired; size and location of storage; method of pumping fuel; etc.—KALMAN STEINER, C. Hoffberger Co., and member of HPAC's board of consulting and contributing editors.

### CONNECTING GAS AND COAL FIRED BOILERS TO STACK

IN THE DECEMBER issue, "A.H." asked for suggestions on an installation in a high school, where it was desired to convert one of the two boilers to automatic gas firing. He said that both boilers are connected to one breeching and one stack, and that there is not enough space in the boiler room to run a separate smoke pipe for the gas fired boiler.

The accompanying sketch offers a method for combining two flues into a common breeching. The flue size for the gas fired boiler is based on recommended practices as well as the size flue for the coal or oil fired equipment. In the sketch will be noted a fixed gas draft check, that

**Method for connecting two different fuel fired boilers into a single breeching, as suggested by "R.H.R." Minimum flue pipe diameters are shown**



is available for gas fired equipment as a standard accessory. It is adjustable and is permanently set by the use of an orsat at the point where satisfactory combustion takes place. A setting at 9 percent $CO_2$ analysis ordinarily permits sufficient leeway in draft variation to insure continued efficient combustion of the fuel.

A barometric damper has been shown for the oil fired boiler, as it is a customary accessory with this fuel. If coal is used instead of oil on the second boiler, a variable draft operated by steam pressure or water temperature should be used.

With the flue sizes used as indicated in the sketch, and with damper settings made by use of an orsat, a satisfactory operation of the two boilers should follow.—R. H. R.

## UNIT HEATER ON ROOF DISSIPATES EXCESS STEAM

IT IS PROBABLY the impression of some residents of Richmond, Va., that the unit heater mounted on the roof of the new Binswanger & Co. warehouse and office building is partly responsible for the mild winter enjoyed by the citizens of that city. Actually, the unit normally operates during the summer only.

The Binswanger Co., dealers in glass and allied building products, generate a part of their steam requirements by burning used packing material and other waste in a low pressure steel heating boiler. As waste disposal is a year 'round problem, the quantity of steam thus generated during the summer months can only be utilized by the mirror-plating equipment and often exceeds the nominal requirements of this operation. Consequently, during the off-heating season, the safety relief valves release an objectionable amount of steam in the boiler room. To overcome this undesirable situation, the unit heater is installed on the roof and fitted with a pressure switch to turn on the unit which in turn condenses the steam upon a rise in the steam pressure.

## WANTS DATA ON SUPPLYING COMBUSTION AIR

YOU ARE INVITED *to answer the following question. Suitable comment on the matter will be welcomed and—space permitting—will be published and paid for at regular rates. Sketches and photos are particularly desired. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

"I am interested in obtaining research and practical application data on the subjects of ventilating furnace rooms and supplying adequate combustion air to furnace and boiler rooms.

"I'd appreciate references to published information on the matter, as well as comment from readers on the general problem and how it has been solved in particular cases."—B. N.

## BIG STORE MODERNIZES WITH AIR CONDITIONING

A CENTRAL station air conditioning system, featuring "the largest air distribution unit in the world for a mercantile firm," is being installed in Kaufmann's department store, Pittsburgh, as part of a $2 million modernization program, according to Carrier Corp. The current project covers complete temperature and humidity control for 12 floors, augmenting an air conditioning system previously installed for the basement and first floor.

All air conditioning machinery, which includes large capacity centrifugal refrigeration machines, dehumidifying apparatus, filters, fans, etc., is to be located in a new penthouse on the roof of the store building. A new cooling tower, as well as an 11,000 volt network electrical substation, are also being installed on the roof adjacent to the new penthouse. There will be a total of 1150 tons of refrigeration capacity.

Since all of the mechanical equipment is concentrated in one room atop the building, maintenance costs are expected to be greatly reduced.

Conditioned air at a rate up to 400,000 cfm will be distributed throughout the store by a system of small, streamlined ducts which blend into the existing ceiling construction. There are no moving parts within business areas in any part of the store. Use of small ducts obviated alterations in the existing location of lights or sprinkler heads, effecting a substantial saving in installation expenditures.

Air conditioning outlets—served by supply ducts in every bay of the store—are readily adjustable to provide any required air quantity to meet the shifting loads frequently encountered in mercantile establishments due to the moving of departments.

One of the largest installations of electrostatic filters in the world for any air conditioning system is employed to remove dust and other foreign matter from all of the air supplied to the store. Air will be supplied to and returned from the various floors through four elevator shafts located in the approximate center of the store. These shafts were made available for this purpose after a survey revealed that 16 new high speed automatic elevators, being installed in the modernization program, will give better service than the 20 old manual elevators.

**This roof-mounted unit heater dissipates excess steam from a boiler burning waste material. (Courtesy Modine Mfg. Co.)**

Heating, Piping & Air Conditioning

AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS

Journal Section

# Laboratory Studies on Heat Flow Within a Concrete Panel†

By C. M. Humphreys*, H. B. Nottage**, C. V. Franks††, R. G. Huebscher‡, L. F. Schutrum□, and D. W. Locklin□, Cleveland, Ohio

This paper is the result of research carried on by The American Society of Heating and Ventilating Engineers at its Research Laboratory located at 7218 Euclid Avenue, Cleveland 3, Ohio

## SUMMARY

**Equipment for studying heat flow within concrete panels is described and results of tests on three panels are reported.**

**An electrical analogue, developed to verify and extend the range of thermal test results, is described. Heat flow rates and temperature distribution, as determined by thermal tests and electrical analogue methods, are compared with values predicted from theory. The experimental studies confirm the fundamental theory given in another paper.**

## THE PROJECT§

In the latter part of 1947, the Society undertook a long-range program of research in panel heating and cooling *to develop data to permit the proper calculation and design of panel heating and cooling systems, with present emphasis on applications for human comfort.* The Technical Advisory Committee on Panel Heating and Cooling, which was formed to assist the Committee on Research and the Laboratory staff in directing the program and interpreting the results, divided the investigation into four divisions, three of which were assigned to separate groups.

The broad outlines of the program were given in the Annual Report of the Committee on Research for 1947[1]. Progress was reviewed in the Annual Reports of the Committee on Research for 1948[2] and 1949[3], and a brief report of some of the work was given at the 55th Annual Meeting in Chicago in January, 1949[4].

Under Group A, which was concerned with heat distribution within and behind the panel, the design and construction of test equipment was begun early in 1948, and laboratory experiments on concrete panels were carried on from the Fall of 1948 to the Summer of 1949.

In the Fall of 1948 a cooperative research project was set up at Columbia University to make a companion study using electrical analogy methods.

Late in 1948 analytical studies were initiated at the Research Laboratory to aid in the interpretation of the results of the experimental investigations on concrete slabs. Early in 1949 a relatively simple type of electrical analogue was built at the Laboratory to verify and extend the range of the data obtained in the experimental studies.

During the Summer of 1949 all preparations were completed for carrying on field tests (during the 1949-1950 heating season) on heat flow to the ground from a concrete slab as influenced by the type and location of insulation below the slab.

A rather comprehensive bibliography of technical papers, reports and articles on panel heating and cooling from both the American and foreign press was prepared by the Laboratory staff and widely distributed in 1948. It has recently been brought up to date and a supplement has been issued to cover material published during 1948 and 1949.

In the last months of 1949 studies on plaster panels were initiated.

This brief summary indicates the extent of the research program in progress under only one of the four groups appointed by the Technical Advisory Committee. It has not been possible to carry on the studies planned by the other three groups as rapidly as those under Group A, but progress is being made at an increasing rate month by month.

Results of the ASHVE Laboratory studies, both experimental and electrical analogue, are presented in brief form in this paper. Later a complete report will be made in the form of a research bulletin. The results of the first portion of the analytical studies are given in a separate research paper[5]. The results obtained in the cooperative studies at Columbia University will be published as another research paper[6].

This paper is a summary of Research Laboratory studies up to the Fall of 1949, including test results, use of electrical analogue for verification and extension of test data, and an interpretation of results in relation to fundamental theory of heat flow within a panel.

†Abstract of this report presented at the 56th Annual Meeting of The American Society of Heating and Ventilating Engineers, Dallas, Tex., January 1950.

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§Outline of Project given by Cyril Tasker, director of research, ASHVE Research Laboratory.

[1]Exponent numerals refer to References.

## INVESTIGATION AND TESTS

Three concrete panels were constructed and tested under conditions to be described. An electrical analogue was developed and used to verify test results, as well as to extend test data to ranges beyond test conditions. Comparisons were then made between the values obtained from tests, those found by the electrical analogue, and those predicted by use of the fundamental theory of heat flow for uniformly spaced pipes buried within a solid panel.

### Heat Flow Tests

Three concrete slabs, each 6 ft square and containing 17 tubes spaced on 4-in. centers, were constructed for these studies. The report presented in January, 1949[1] gave details of the method of slab construction and contained a brief illustrated description of the test methods and instrumentation used. Table 1 summarizes pertinent data on the three slabs.

The tubes in each slab were arranged in a manifolded grid so that tube spacings of 4, 8, 12 and 16 inches could be obtained in tests through the use of selective valving. Special heat absorbers and guards, designed and built at the Research Laboratory, made it possible both to measure and to control the rate of heat transfer from each side of the slab. Supply water to the slab and each absorber was independently controlled and could be held to within ±0.5 deg through a range of 85 F to 160 F for the slabs and 50 F to 120 F for the absorbers. A sectional view of the slab and absorbers is shown in Fig. 1. The heat flow rate was measured by heat flow meters on each absorber and was checked by calorimetry from measurements of the flow rate and temperature rise of the water passing through each absorber. Fifty-five (55) thermocouples, located within the slab and on the two surfaces, permitted accurate determinations of the temperature patterns. Thermal equilibrium was established for each test condition prior to the collection of test data.

At least five tests were made on each slab with both sides bare, for each of four tube spacings. Conditions for each series of five tests were chosen to give heat releases from the upper surface of the slab of approximately 0, 25, 50, 75 and 100 percent of the heat supplied, the remainder being given up by the lower surface.

Tests were also made at all four tube spacings with the upper surfaces of slabs 1 and 2 covered with carpet and carpet padding, and also with several thicknesses of insulation. Additional tests were made on slab No. 1 after a $\frac{1}{8}$-in. asphalt tile floor had been applied to the upper surface.

### Use of Electrical Analogue

While tests on the third slab were still in progress, an electrical analogue was constructed to verify and extend the range of the thermal data obtained on the slabs. The arrangement of the analogue is shown diagrammatically in Fig. 2 and the parts are shown in Fig. 3.

In using the analogue the following equivalents were employed:

| *Thermal Quantity* | *Electrical Quantity* |
|---|---|
| Temperature difference, $\theta$ | Voltage difference, $E$ |
| Heat flow rate, $q/A$ | Current, $I$ |
| Thermal conductivity, $k$ | Electrical conductivity, $k_e$ |
| Thermal conductance, $C$ | Electrical conductance, $C_e$ |

**Table 1—Slab Dimensions**

| Slab No. | Nominal Tube Diam. In. | Type of Tubes | Depth of Cover, In.[a] | | Nominal Slab Thickness In. |
|---|---|---|---|---|---|
| | | | Top | Bottom | |
| 1 | $\frac{3}{4}$ | non-ferrous | $3\frac{1}{2}$ | 5 | $9\frac{3}{8}$ |
| 2 | $\frac{3}{4}$ | non-ferrous | $1\frac{1}{2}$ | $2\frac{1}{2}$ | $4\frac{7}{8}$ |
| 3 | $\frac{3}{4}$ | ferrous | $1\frac{1}{2}$ | $3\frac{1}{2}$ | 6 |

[a]Cover depth measured from slab surface to edge (not center) of tubes.

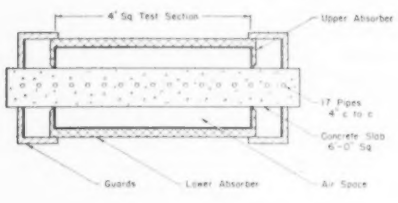



Fig. 1—Sectional view of concrete panel and absorbers

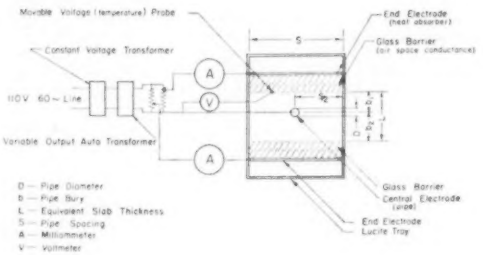



Fig. 2—Schematic diagram of analogue

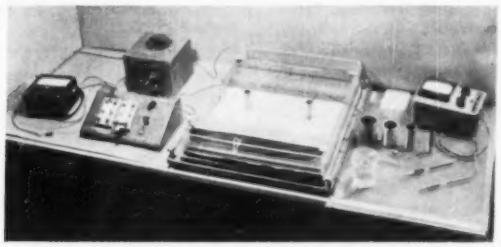


Fig. 3—View of electrical analogue

The slab dimensions, and the major thermal quantities involved are shown in Fig. 4.

Referring to Fig. 2, the analogue tank width was 16 in., the same as the maximum tube spacing tested. The slab simulated in Fig. 2 had thickness $L$, depths of bury $b_1$ and $b_2$, and had tubes of diameter $D$ spaced $s = 16$ in. on centers. To simulate the same slab with 8-in. tube spacings, the central electrode would have consisted of two tubes 8-in. apart. Thus the geometry of the slab is completely duplicated between the glass barriers of the analogue.

The air space conductances were simulated by adjusting the glass barriers shown in Fig. 2 so that the ratio of the electrical conductivity, $k_e$, of the electrolyte to the electrical conductance, $C_e$, of the glass barrier was equal to the ratio of the thermal conductivity, $k$, of the concrete to the thermal conductance, $C$, of the air space, or

$$\frac{k}{C} = \frac{k_e}{C_e}$$

The air space conductances set up in the analogue were related as given to those determined in tests on the slabs. The end electrodes represented the absorber plates of the slab thermal tests.

## Thermal Performance Data

Consistency of the laboratory data was checked as each run was made by plotting the observed performance in a simple but convenient form. The curves of Fig. 5 were drawn through points obtained for bare slabs. Points for insulated slab tests fell on or were very close to the same curves.

The *flux factor* employed as the ordinate on these curves is merely the ratio: (observed rate of heat flow from the pipe to the slab surface concerned) ÷ (rate of heat flow which would exist to this same slab surface if the pipes were replaced by a plane sheet through their centerlines having the same temperature as the pipe surface, the slab surface temperature remaining unchanged). *The flux factor curves show performance trends only; they are not for design use,* being restricted to particular test conditions.

The validity of each performance test was checked by working out the heat balance on the absorber assembly.

## Interpretation of Results

As has already been noted a careful study of the theory of heat flow within a slab was made concurrently with the laboratory testing program. A satisfactory analytical solution was developed, and is presented in another paper[8]. Both the thermal test data and the analogue extensions thereof were analyzed on the basis of this theory.

### *Variables Involved and Their Reduction*

The heat flow rate through a slab surface, even when limited to steady-state conditions, may vary over a very wide range as influenced by the following variables of construction and operation: (1) environmental conditions (which are represented in these tests by absorber temperatures), (2) water temperature, (3) pipe spacing, (4) pipe bury, (5) pipe diameter, (6) slab thickness, (7) pipe material, (8) insulation (of variable thickness and thermal conductivity) on slab surface, (9) slab thermal conductivity, and (10) thermal conductances between the slab surfaces and the respective environments.

Since it was necessary, in organizing the analysis of the data, to simplify wherever possible, the following steps were taken and justified as noted in following paragraphs:

1. Detailed study was limited to the heat flow process within the slab. Absorber temperatures and air-space conductances were replaced as variables of analytical interest by the mean slab surface temperatures. Though it was recognized that the slab surface temperature wave had an influence on the thermal system, it was also realized that the influence was quantitatively small within the scope of the present tests and that an adequate experimental treatment would be rather lengthy.

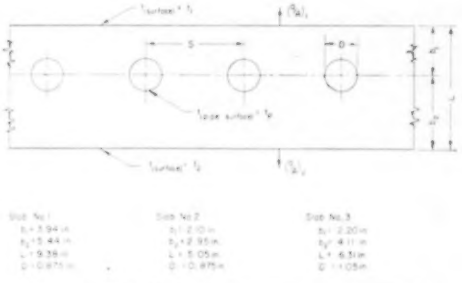


Fig. 4—Slab thermal and geometric quantities

2. The pipe material (ferrous or nonferrous) was ruled out as an important *thermal* variable for the concrete slabs involved. Calculations showed that the thermal resistance of the pipe, regardless of the metal used, was entirely negligible in relation to the other thermal resistances involved. The heat flow was therefore analyzed in terms of the pipe surface temperature rather than the water temperature.

3. The four geometrical variables, pipe spacing $s$, pipe centerline bury $b$, pipe outer diameter $D$, and slab thickness $L$, were reduced to three by considering only the dimensionless ratios $s/L$, $b/L$, and $D/L$.

4. Insulation was considered to be merely a thermal resistance added externally and independently to the heat-flow system within the slab. That this was justified, for the test range involved, was shown by an examination of the slab temperature patterns with and without insulation, by analogue observations, and by the adequacy of the final data correlation obtained on such a basis.

5. The fundamental theory indicated that the results (as plotted in Figs. 7, 8 and 9 discussed later) were independent of the thermal conductivity of the slab. This was also demonstrated by the fact that the analogue results were not dependent upon the electrolyte conductivity. This is true because of the particular method of plotting; it does not mean that the performance of a system installed in the field is independent of the thermal conductivity of the materials used in the panel construction.

**Table 2—Suggested Maximum Values of $D/L$ and $s/L$ for which the Influence of the Slab Surface Temperature Wave May Be Neglected**

| $b/L$ | $D/L$ | $s/L$ |
|---|---|---|
| 0.15 | 0.10 | 2.0 |
| 0.30 | 0.30 | — |
| 0.50 | 0.80 | 6.0 |

### *Heat Flow and Temperature Difference Components*

Interpretation of the experimental data was simplified by following the method of the fundamental theory[5] and resolving the heat flow rate and temperature difference across each slab surface into two components, which may be defined as follows:

1. The *source component* is the magnitude which would prevail if the slab surfaces were isothermal at the same temperature and the tubes were the only sources of heat.

2. The *linear component* is the magnitude which would prevail if the sources (tubes) were removed and the slab surfaces were isothermal but at different temperatures. In this case the only heat flow would be from the higher temperature surface to the lower temperature surface.

A *surface temperature wave component*[5] is a third component entering into the total heat flow rate, but its influence in the present analysis has been neglected. The effect of this component increases with increase in tube spacing and decrease in depth of bury. Until the effect of this third component has been investigated and evaluated, it is recommended that applications of these data be limited to the values of $D/L$ and $s/L$ given in Table 2.

### *Comparison Between Thermal Measurements and Analytical Predictions*

The fundamental theory can best be validated by establishing a reasonable agreement between test results and predicted performance within the range covered. This will permit the analytical method to be employed as the basis of practical design material.

The first item of comparison is the rate of heat flow through the slab surfaces. The data give the total mean rates of heat flow through these surfaces. The linear component is computed and sub-

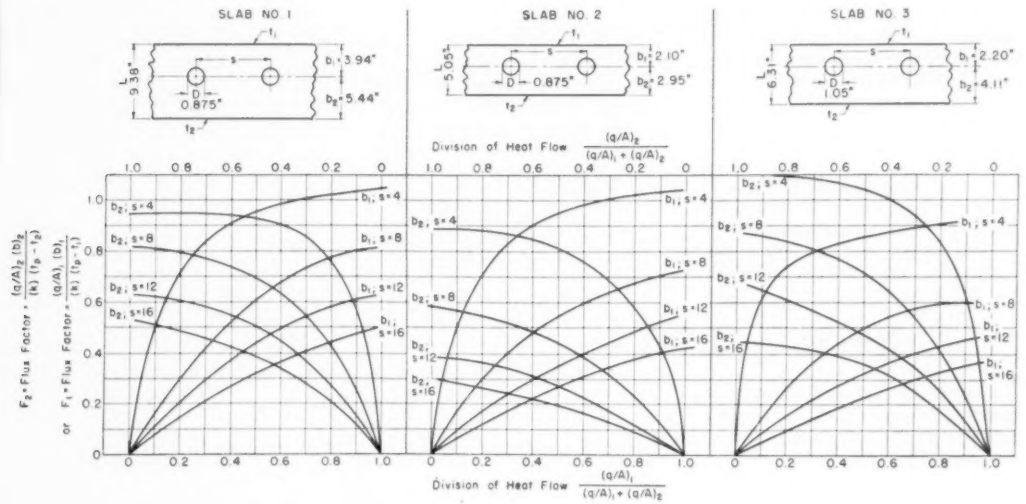



**Fig. 5—Thermal performance observations for slabs Nos. 1, 2, 3**

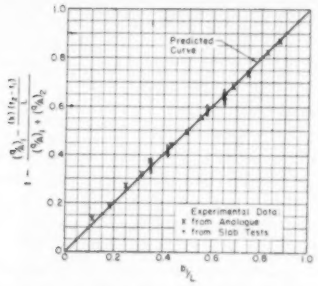



**Fig. 6—Comparison of experimental and predicted source heat flow component on the basis of slab data and analogue data**

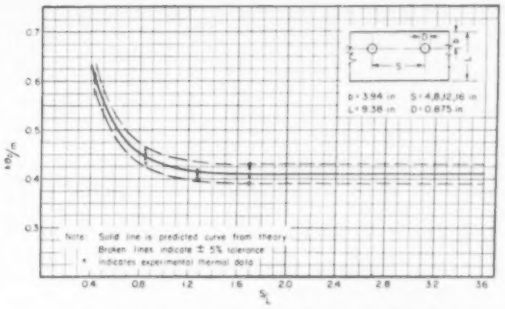

b = 3.94 in S = 4,8,12,16 in
L = 9.38 in D = 0.875 in
Note: Solid line is predicted curve from theory
Broken lines indicate ± 5% tolerance
• indicates experimental thermal data

**Fig. 7—Comparison of experimental and predicted source components of the pipe to mean surface temperature difference for slab no. 1**

tracted from the totals to leave an experimentally - determined source component. Fig. 6 shows the comparison of the experimental and predicted source-component quantities; a narrow band along the predicted line would cover all valid test data. Here the theory is judged to be well confirmed within the limits investigated.

The second item of comparison is the difference between the pipe and the mean slab surface temperatures. Here likewise an experimental determination of the source component of this difference is obtained by subtracting a computed linear-flow contribution from the measured difference. Figs. 7, 8 and 9 compare the results with the predictions, where $\theta_p$ is the source-component temperature difference, $k$ is the slab thermal conductivity in foot units, and $m$ is the Btu per (hour) (linear foot) heat flow from the pipe. Considering that the experimental magnitudes of $\theta_p$ are probably valid only to ± 1 deg, this places a ± 5 percent tolerance on the predicted curve for the magnitudes of $k$ and $m$ involved in the tests; the dashed lines indicate this tolerance.

The rise of the experimental points above the predicted curves at higher magnitudes of $s/L$, Figs. 8 and 9, is a consequence of having neglected the surface temperature wave component of the slab temperature field in the theory developed thus far[1]. Preliminary estimates of the effect of including this component bring the experimental results and the predictions into good agreement over the entire range covered. The consistently high location of the mean trend of the experimental points in Fig. 9 is most probably due to an accidental departure from the supposed depth of bury, or possibly to an erroneous thermal conductivity.

These results are considered to validate the theory, subject to the limitations mentioned.

### *Comparison Between Analogue Measurements and Analytical Predictions*

Once properly adjusted on the basis of thermal data to simulate the slab system, the analogue becomes a convenient tool for extending the range of the comparisons between predictions and experiments.

Again the first comparison is for the source component of the heat flow. Here it is most convenient to operate the analogue with both slab boundaries represented by elec-

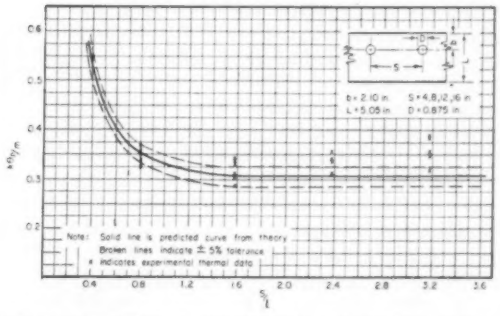

b = 2.10 in S = 4,8,12,16 in
L = 5.05 in D = 0.875 in
Note: Solid line is predicted curve from theory
Broken lines indicate ± 5% tolerance
• indicates experimental thermal data

**Fig. 8—Comparison of experimental and predicted source components of the pipe to mean surface temperature difference for slab no. 2**

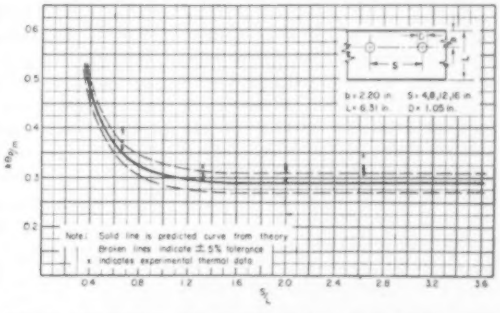

b = 2.20 in S = 4,8,12,16 in
L = 6.31 in D = 1.05 in
Note: Solid line is predicted curve from theory
Broken lines indicate ± 5% tolerance
• indicates experimental thermal data

**Fig. 9—Comparison of experimental and predicted source components of the pipe to mean surface temperature difference for slab no. 3**

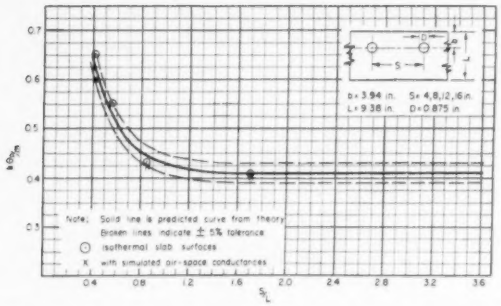

b = 3.94 in. S = 4,8,12,16 in.
L = 9.38 in. D = 0.875 in.
Note: Solid line is predicted curve from theory
Broken lines indicate ± 5% tolerance
isothermal slab surfaces
with simulated air-space conductances

**Fig. 10—Comparison of analogue data and predictions of the source component of the pipe to mean surface temperature difference for slab no. 1**

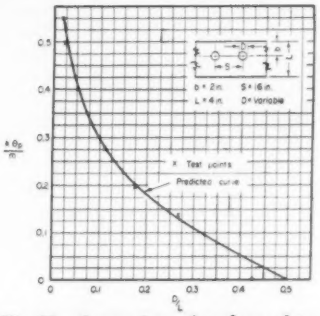



**Fig. 11—Comparison of analogue data and predictions of the source component of the pipe to mean surface temperature difference for varying ratios of $D/L$**

trodes maintained at the same voltage, *i.e.* isothermal slab surfaces at the same temperature. Fig. 6 shows this comparison and indicates satisfactory agreement between analogue results and the fundamental theory thereby giving confidence to both the theory and the use of the analogue.

The source component of the pipe-to-surface temperature difference is the subject of the comparison in Fig. 10 wherein slab No. 1 has been simulated. The first series of points shows the measurements obtained with equipotential (isothermal) slab surfaces. Since the theory is exact for this condition, the departure of the points from the predicted curve indicates slight imperfections in the analogue technique.

The second set of points was obtained with an analogue simulation of the air-space conductance prevailing in the corresponding thermal tests. The essential agreement between the two sets of points indicates that in the analogue representation of slab No. 1, as in the thermal tests, the surface voltage (temperature) wave has a very minor influence; hence, data correlation is satisfactory based upon mean surface conditions.

The laboratory analogue was not an elaborate one, and it is judged that a ± 5 percent tolerance upon its indications is reasonable. This is of the same order as for the thermal tests.

Use of the analogue to demonstrate the theory in a region not covered by the thermal tests is exemplified by Fig. 11. Here the effect of a changing ratio of pipe diameter to slab thickness is indicated for the source component of the pipe-to-surface temperature difference, $\theta_p$. The experimental points were obtained with equipotential (isothermal) slab boundaries.

To summarize, analogue measurements have been shown to agree well with the theory for variations of each of the three geometrical ratios, $b/L$, $s/L$, and $D/L$. These measurements, moreover, were also demonstrated by actual test to be

### Nomenclature

$b$ = centerline bury of pipe, inches or feet, taken as $b_1$ or $b_2$ in accord with Fig. 4.

$C$ = thermal conductance, Btu per (hour) (square foot) (Fahrenheit degree).

$C_e$ = electrical conductance, (reciprocal of resistance in ohms).

$D$ = pipe outer diameter, inches or feet.

$E$ = electrical potential, volts.

$I$ = electrical current, amperes.

$k$ = thermal conductivity, Btu per (hour) (square foot) (Fahrenheit degree per foot).

$k_e$ = electrical conductivity, (reciprocal of resistance in ohms/foot).

$L$ = slab thickness, inches or feet.

$m$ = pipe heat flow rate (source strength), Btu per (hour) (linear foot).

$q/A$ = heat flow rate, Btu per (hour) (square foot).

$R_i$ = thermal resistance of insulation over slab surface (hour) (square foot) (Fahrenheit degrees) per (Btu).

$s$ = pipe centerline spacing, inches or feet.

$t_1, t_2$ = mean slab surface temperatures, Fahrenheit degrees.

$t_i$ = mean insulation surface temperature, Fahrenheit degrees.

$\theta$ = temperature difference, Fahrenheit degrees.

$\theta_p$ = source component of difference in temperature between the mean slab surface and outer pipe surface temperatures, Fahrenheit degrees.

consistent for different values of $k$, $\theta_v$ and $m$, so long as the modulus $(k\theta_v/m)$ had the same magnitude.

*Effect of Insulation Over Slab Surface*

So long as the surface-temperature-wave components of the heat flow rate and of the pipe-to-surface temperature difference are negligible (which is the range within which this report is limited) no modifications of the fundamental analysis or its interpretations are necessary to account for insulation as far as the slab performance, in itself, is concerned. The slab surface conditions are still adequately represented by a mean surface temperature, and the addition of insulation merely interposes a certain thermal resistance between the slab surface and the environment. In the steady state all of the heat passing through the slab surface also passes through the insulation surface, so that the difference between the mean slab surface temperature $t_i$ and the mean insulation surface temperature $\bar{t}_i$ is

$$(t_i - \bar{t}_i) = (q/A)_i R_i$$

*where*

$R_i$ = the insulation thermal resistance, (Fahrenheit degrees) (square foot) (hour) per (Btu)

Adding surface insulation with a given environment will change the mean temperature and rate of heat flow through the side of the slab originally exposed to this environment; and, other conditions remaining unchanged, this will produce a corresponding alteration on the far side of the slab. This conclusion has been validated by both thermal and analogue test data.

### Conclusions

Experimental studies of heat flow in concrete slabs, and data obtained by means of an electrical analogue, have confirmed the fundamental theory developed for the analysis of heat flow in panel heating sections[5].

The thermal test system designed and operated at the Research Laboratory has proved capable of yielding trustworthy data.

The electrical analogue has been shown to be a convenient means for extending the range of data obtained by thermal tests.

### References


1. 1947 Annual Report of the Committee on Research. (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, March 1948, p. 119.)

2. 1948 Annual Report of the Committee on Research. (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, March 1949, p. 119.)

3. 1949 Annual Report of the Committee on Research. (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February 1950, p. 124.)

4. Performance of Heating Panel Studied. (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, April 1949, pp. 112-114.)

5. Heat Flow Analysis in Panel Heating or Cooling Sections, For Uniformly Spaced Pipes Buried Within a Solid Slab, by L. E. Hulbert, H. B. Nottage, and C. V. Franks. (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, April 1950, p. 117.)

6. Electric Analogger Studies on Panels with Imbedded Tubes, by Carl F. Kayan. (To be published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May 1950.)


## CONCRETE FROM SMOKESTACKS

A concrete that uses fly-ash for part of the cement is called *pozzolan*. It is, however, not a new invention, because the Greeks used it more than 2000 years ago, getting their fly-ash from volcanic deposits. Today's fly-ash is obtained from industrial smokestacks.

And speaking of unusual terms, guess where *pozzolan* is to be used? In building Hungry Horse Dam in Montana.

## EARLY CANADIAN WINTER TESTS SNOW MELTING SYSTEM

A 130 foot sidewalk heating system installed in front of a store building in St. Johns, Newfoundland, got its first workout early in December when 10.3 in. of snow fell. The system was designed and installed by F. J. Ryan, ASHVE member, St. Johns.

## OIL STATISTICS PUBLISHED

A handy reference book on the major statistics of oil has been compiled by the Art Industry Information Committee and is known as the *Petroleum Industry Record — 1918 - 1948*. It contains a series of tables and graphs showing the progressive development of the oil industry and the expanding use of petroleum as a source of energy for light, heat, power, transportation and mechanization. Copies may be obtained from J. A. McNally, American Petroleum Institute, 50 West 50th St., New York 20, N. Y., at 50 cents per copy. Bulk orders provide discounts: 1 to 50 copies, 50 cents each; 51 to 100 copies, 35 cents each; and 101 and up, 25 cents each.


**BIBLIOGRAPHY SUPPLEMENT ON PANEL HEATING**

A supplement covering 140 articles on Panel Heating appearing in American and foreign technical magazines during 1948 and 1949, has just been completed by the ASHVE Research Laboratory and is now available for addition to the Bibliography on Panel Heating published in 1948.

ASHVE members may obtain one free copy. For additional copies, and for non-members, the price is 50¢ each. Application should be made to

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

51 Madison Ave.
New York 10, N. Y.

# Air Conditioning an Ocean Liner*

by Robert Tate**

The central plant located in the new machinery flat aft of the main engine room consists of two 2-stage centrifugal-type compressors, each driven by a 272-hp turbine taking steam at full boiler pressure and superheat and exhausting at full vacuum. Each compressor has a rated capacity of 240 tons of refrigeration at full rated speed of 6350 rpm and with circulating water at 85 deg F. The refrigeration capacity of the system is adequate to maintain a dry bulb temperature of 80 deg F throughout with relative humidity of 42 percent in staterooms or 51 percent in crew quarters or public spaces while the outside dry bulb temperature is 90 deg F and the relative humidity is 66 percent. The centrifugal compressor and turbine are mounted in a single unit with the water chiller and Freon condenser to give a compact and efficient assembly. Expansion of the refrigerant in the water chiller cools the circulating water which is then piped throughout the ship to the fan rooms for the cooling of air. Three 40-hp motor-driven pumps of 1200 gpm at 150 ft head are used for circulating this water, one of the three pumps being a standby.

Also located in the central plant are three hot water heaters, the heated water from which is circulated to the staterooms to provide terminal reheat. Hot water is circulated at two temperatures in two separate systems, one at 180 deg maximum for passenger staterooms and one at 240 deg maximum for crew quarters. The hot water is circulated with three 20-hp motor-driven pumps with an operating capacity of 500 gpm each at 195 ft head. Operation of all equipment is substantially automatic, although supervision is available since the ship's service and cargo refrigeration system compressors are located in the same space, and refrigeration operators are available for control of the two systems.

The fans for the 31 systems supplying air to the various air conditioned spaces are located in acoustically lined fan rooms, of which there are 14 distributed throughout the vessel. All fans are of the centrifugal, belt-driven type, those for the public spaces being integral with the cooling coils in a unit, while those for other spaces are separate from the coils. Since all fans are located in enclosed fan rooms, the motors are of the drip-proof type only. All fans receive air from the weather through oil-coated metal filters and through steam preheater coils which operate when the outside temperature falls below 52 deg F.

Passenger stateroom systems are eight in number. Air from the fan room unit is distributed through a ductwork system to the staterooms at a predetermined dew point temperature of approximately 52 deg F. At the stateroom this conditioned air enters a unit where it is ejected to the room through a venturi nozzle. The venturi effect of the nozzle creates a suction which induces a flow of air from the room into the unit where it is mixed with the conditioned air from the duct system.

Since the mixture is still below comfort level, a hot water coil located in the stream of induced air reheats this to such a degree that the resultant mixture will be controlled and maintained at the temperature desired by the room occupant. It will be seen that the total circulation of air in this system is in effect considerably greater than would be the case if only the amount of air coming from the fan room were discharged into the stateroom without recirculation. It will also be seen that, since supplemental cooling in the stateroom is not required, the coil located in the room terminal unit is required only to heat but never to cool, and there is no possibility of condensation. Hence, there is no requirement for drip pans and piping to remove condensate, no chilled water control valve or chilled water piping, and no tendency to accumulate caked dirt so often characteristic of room cooling coils. Excess air is removed from the room by conventional exhaust system terminals, some of which are located in the bathroom spaces, while the remainder is exhausted through the passageways.

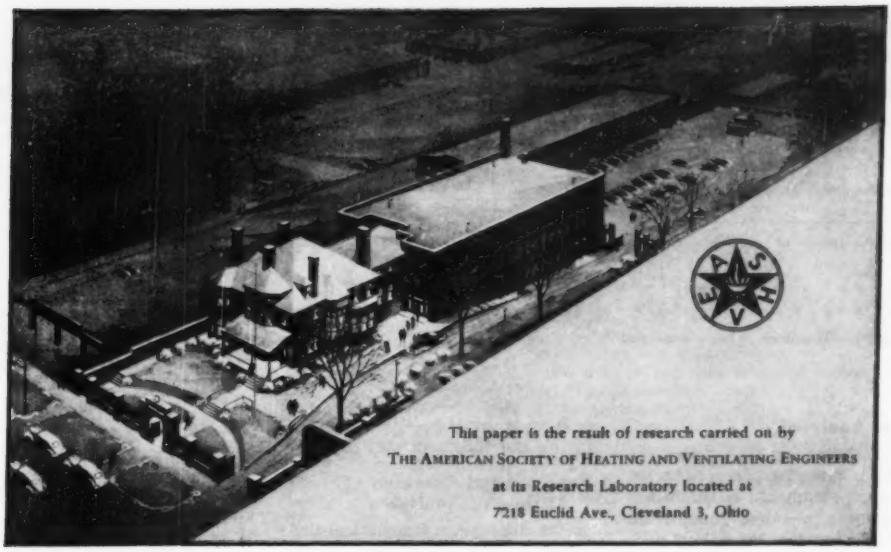
As originally constructed, the *Lurline* was fitted with air conditioning equipment in the main dining salon only. All other parts of the passenger and crew spaces, as well as of the engineering and service spaces, were ventilated with conventional mechanical supply and exhaust systems distributing through the usual ductwork, and in the passenger spaces, terminating in the so-called *punkah louver* type of outlet. Fans were located on open deck spaces and promenades and were of the centrifugal type with waterproof, totally enclosed motors.

Upon determination that the reconversion should include installation of complete air conditioning in all passenger staterooms, passenger public spaces, and crew and officer quarters and messrooms, a careful study was made of all types of air conditioning equipment available for marine application. It was decided eventually that a medium-pressure type system with induction-type recirculation and individual thermostatic control of temperatures should be used in passenger staterooms while a conventional terminal reheat system would be satisfactory in crew quarters, and that a centrifugal-type Freon 11 central cooling plant would best serve the requirements of a large passenger vessel of this type.

Although the basic system selected was not new and had been used extensively in shoreside installations, there were a considerable number of features in connection with a large marine installation of this type which presented novel problems and involved a good deal of experimentation and careful development during the process of installation.

*Abstract of paper presented before the *Society of Naval Architects and Marine Engineers*, New York, N. Y.

**Assistant to Vice President, Matson Navigation Co., San Francisco, Calif.


This paper is the result of research carried on by
THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
at its Research Laboratory located at
7218 Euclid Ave., Cleveland 3, Ohio

# Heat Flow Analysis in Panel Heating or Cooling Sections

## For Uniformly Spaced Pipes Buried Within a Solid Slab†

By L. E. Hulbert*, H. B. Nottage** and C. V. Franks††, Cleveland, Ohio

**SUMMARY—A set of curves applicable to the case of uniformly spaced pipes buried within a solid slab having isothermal surfaces has been developed for the purpose of relating the following quantities: (1) rate of heat release (or pick-up) per linear foot of pipe, (2) thermal conductivity of the slab, (3) difference between the pipe and mean slab surface temperatures, (4) spacing between adjacent pipes, (5) slab thickness, (6) tube outer diameter, and (7) position of the pipe grid between the slab surfaces. Simple equations are given for establishing the division of heat flow between the two surfaces. Data derived from analysis have received experimental confirmation.**

THE OBJECTIVE of the ASHVE program of panel heating and cooling Research is the development of sound and acceptable design data and design methods which may be used in the majority of present day applications[1]. The program is broad in its conception and, for purposes of convenience, was so organized that it could be broken down into a number of important constituent parts which could be investigated independently and concurrently. One of these main divisions includes the study of heat flow within a panel.

This paper is the first of a group dealing with the *theory of heat flow in a slab*. The development of analytical solutions of basic problems of heat flow will save experimental time and permit application of the data beyond the limits covered entirely by experiment.

Another paper[2] reviews briefly the experimental parts of the program under way at the Society's Research Laboratory and discusses the correlation between the theory developed here and the results obtained in studies on a number of concrete slabs. A third paper[3] presents the results of cooperative research at Columbia University employing its Electric Analogger. The part of the program covered by these three papers is being carried on under the general guidance of Group A□ of the Technical Advisory Committee on Panel Heating and Cooling.

†Abstract of this report presented at the 56th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Dallas, Tex., January 1950.

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[1]Exponent numerals refer to References.

□Personnel of *Group A*—TAC on Panel Heating and Cooling: A. B. Algren, *Chairman*; C. E. Abbey, R. A. Biggs, R. S. Dill, H. L. Flodin, F. E. Giesecke, W. S. Harris, C. F. Kayan, G. D. Lain, R. L. Maher, C. W. Meininger, D. L. Mills, C. W. Nessell, P. S. Park, S. I. Rottmayer, E. E. Scott, S. K. Smith, R. K. Thulman, S. M. Van Kirk, W. J. Widmer, G. L. Wiggs.

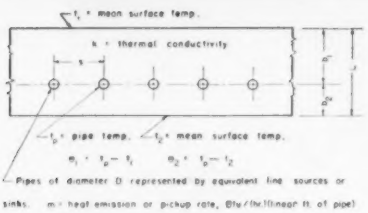

$t_s$ = mean surface temp.
k = thermal conductivity
s
d'
d
$t_p$ = pipe temp.
$t_2$ = mean surface temp.
$\theta_1 = t_p - t_1$
$\theta_2 = t_p - t_2$
Pipes of diameter D represented by equivalent line sources or sinks.
m = heat emission or pickup rate, Btu/(hr.)(linear ft. of pipe)

**Fig. 1—The slab system analyzed**

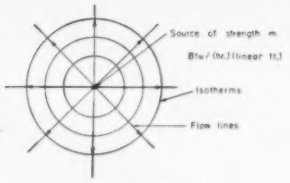



**Fig. 2—Flow-line and isotherm network for a line source of strength $m$ in an infinite medium**

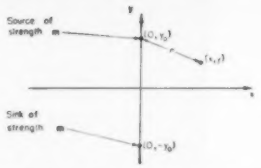



**Fig. 3—Combination of a line source and line sink which yields the temperature field in a semi-infinite medium having an isothermal surface along the x-axis**

## System Analyzed

Fig. 1 shows the slab system as set up for analysis. As a basis for reasoning, steady-state conditions are assumed in a two-dimensional region of constant thermal conductivity and uninfluenced by possible edge effects. The mean surface temperature is defined as the mean along a line running perpendicular to the pipe axis.

Use of a line source to represent a pipe is permissible in the range where isotherms about the source are essentially circles corresponding to the tube outer diameter. Since departures occur when the tube is tangent to or very close to the slab surface, it is planned to consider this effect and develop a method of calculation to compensate for it in a subsequent paper. For the present the analysis given here should *not* be applied for ratios of pipe outer diameter $D$, to slab thickness $L$, greater than those given in Table 1,

**Table 1—Suggested Maximum Limits of $D/L$ for Use of the Theory of This Paper**

| $b/L$ | *Max.* $D/L$ |
|---|---|
| 0.15 | 0.10 |
| 0.30 | 0.30 |
| 0.50 | 0.80 |

where $b$ denotes the distance between the pipe centerline and the slab surface concerned. If these limits are exceeded, the predicted difference between the maximum and minimum temperature about the tube circumference becomes greater than 2.5 deg.

Another paper[2] offers some interim suggested limits on $s/L$, the ratio of pipe spacing to slab thickness, which may be followed in applying the theory of this paper.

## Fundamental Concepts of Method of Analysis

The complete mathematical derivation of the theory used in this analysis will not be presented at this time but will be included when this paper is published in the ASHVE TRANSACTIONS[1]. The concepts basic to the theory are treated extensively by Hague[4].

A first concept is the use of sources and images or sinks in analyzing heat flow. Consider an infinite medium of thermal conductivity $k$ containing a line source of strength $m$, *i.e.*, emitting $m$ Btu per (hr) (linear ft). Fig. 2 shows a section taken perpendicular to the line source. The isotherms here will be circles about the source, and the temperature difference between two isotherms of radii $r_1$ and $r_2$, where $r_2 > r_1$, will be

$$\theta = t_1 - t_2 = -\frac{m}{4\pi k} \log_e \left(\frac{r_1}{r_2}\right)^2 \quad \ldots\ldots (1)$$

Next suppose that at some one point in the medium the temperature is known, and call this the *datum temperature*, $t_d$. A coordinate system may be located in the medium by taking the origin at the point of known temperature and passing the $y$-axis through this point and the source point. The source is then at the point $(0, y_o)$, Fig. 3, and $r$ of Equation 1 becomes $\sqrt{x^2 + (y - y_o)^2}$. This establishes a coordinate reference for the temperature field.

[1]Pending publication of the ASHVE TRANSACTIONS copies of this derivation may be obtained in mimeographed form on application to the Society.

If a second source were placed in the medium, its temperature contribution at any point could be referred to the same datum temperature, $t_d$, at the coordinate origin. Then, by the superposition principle the temperature at any point would be the algebraic sum of the contributions from the two sources, both contributions being referred to $t_d$. Algebraically, if $(t_a - t_d)$ were the temperature contribution of the first source at some point and $(t_b - t_d)$ that of the second source at the same point, the combination would produce a temperature $t$ given by

$$\theta = (t - t_d) = (t_a - t_d) + (t_b - t_d).$$

Let the superposition be applied to the case of a sink (negative source) of strength $m$ being located at the point $(0, -y_o)$; this sink may be regarded as the *image* of the source in the coordinate axis. The temperature at any point $(x, y)$ resulting from the source and sink combination is given by

$$\theta = t - t_d = -\frac{m}{4\pi k} \log_e \left(\frac{x^2 + (y - y_o)^2}{x^2 + (y + y_o)^2}\right) \quad \ldots\ldots (2)$$

In Equation 2, $\theta = 0$ when $y = 0$, which means that the $x$-axis is an *isotherm* at the datum temperature. Thus, the system of Fig. 3 serves to represent the case of a line source in a semi-infinite conducting medium and located parallel to an isothermal plane boundary. Equation 2 gives the temperature field, restricting $y$ to lie within the medium. Knowing the temperature field and

the thermal conductivity, the heat flow rate at any point may be derived mathematically.

Superposing the combination of a second isothermal surface at the same datum temperature and a series of uniformly spaced parallel sources, there results the slab system of Fig. 1, except that the case desired is a slab having *different* mean surface temperatures. The superposition concept can be extended to meet this requirement. Upon the system of the row of sources (pipes), between two isothermal surfaces having the same temperature, there is superposed a linear heat flow across the slab as if the sources were not present and the two surfaces were at different temperatures. The heat flow or temperature field in a slab is therefore the resultant of two components which may be defined as follows:

1. *Source component* is the magnitude which would prevail if the slab surfaces were isothermal at the same temperature and the pipes were the only sources of heat.

2. *Linear component* is the magnitude which would prevail if the sources (pipes) were removed and the slab surfaces were isothermal but at different temperatures. In this case the only heat flow would be from the higher temperature surface to the lower temperature surface.

The final combination is represented schematically in Fig. 4 and must be kept clearly in mind as the basis of the present analysis.

### Analytical Results

In this paper results are presented only in a generalized form; the presentation of simplified material for use in practical applications will be made elsewhere. Here both the temperature difference and heat-flow rates are expressed as the sum of two parts, a *source* component and a *linear-flow* component, in accord with the superposition discussed above.

#### Nomenclature

$b$ = distance from pipe centerline to slab surface, inches, designated as $b_1$ and $b_2$ for the two slab surfaces, respectively.
$D$ = outer pipe diameter, inches.
$k$ = slab thermal conductivity, Btu per (hour) (square foot) (Fahrenheit degree per foot).
$L$ = slab thickness, inches.
$m$ = pipe heat emission (or reception) rate, or source (or sink) strength, Btu per (hour) (linear foot).
$(q/A)_1$ = mean heat flow rate through slab surface having temperature $t_1$, Btu per (hour) (square foot of surface).
$(q/A)_2$ = mean heat flow rate through slab surface having temperature $t_2$, Btu per (hour) (square foot of surface).
$r_1, r_2$ = radial distances from source, inches.
$s$ = centerline pipe spacing, inches.
$t_1, t_2$ = mean slab surface temperatures, Fahrenheit degrees.
$t_d$ = datum temperature, Fahrenheit degrees.
$t_p$ = mean pipe outer surface temperature, Fahrenheit degrees.
$\theta$ = $(t - t_d)$, in general, Fahrenheit degrees.
$\theta_p$ = $(t_p - t_1)$ or $(t_p - t_2)$, as desired, Fahrenheit degrees.
$x, y$ = coordinate dimensions, inches.
$y_o$ = source coordinate, Fig. 3, inches.

#### *Pipe-to-Surface Temperature Differences*

Referring to Fig. 5, the difference between the pipe temperature, $t_p$, and the mean surface temperature $t_1$ is

$$(t_p - t_1) = \theta_p + (t_2 - t_1)\left(\frac{b_1}{L}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

where the subscripts 1 and 2 may be interchanged if desired.

Here the term $\theta_p$ is the source contribution and is obtained from the curves of Figs. 6a through 6f once the slab geometry, source strength and slab thermal conductivity are known. (The factor $b$ in Fig. 6 would be taken as $b_1$ consistent with Fig. 5 and Equation 3). The source strength $m$ in Fig. 6 must always be the *total* heat flow per linear feet of pipe to *both sides* of the slab. The relationship for proportioning this total between the two sides is given in the next section. In an application problem the rates of heat flow through the surface would be further linked to the remainder of the thermal circuit outside of the slab. Arithmetic interpolation will be satisfactory between the curve families of Figs. 6a through 6f. For values of $s/L$ greater than 1.6, the curve for $(s/L) = 1.6$ is to be used so long as the slab surfaces remain isothermal. The term $(t_p - t_1)(b_1/L)$ in Equation 3 represents the influence of the linear-flow com-

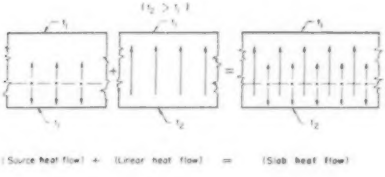



Fig. 4—Principle of superposition

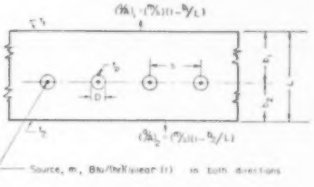
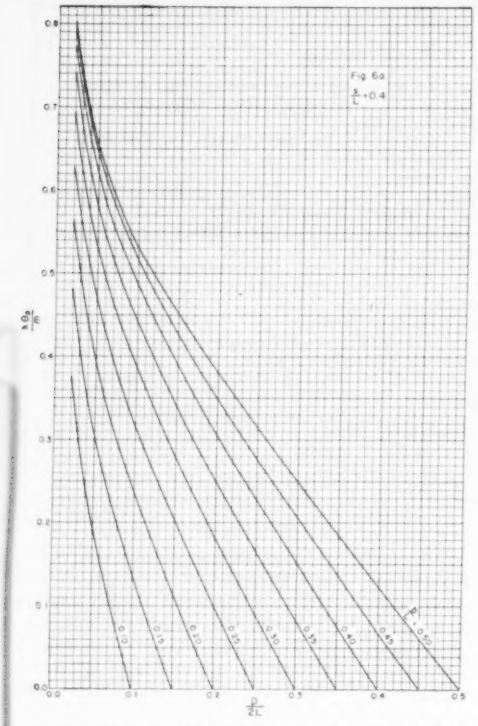
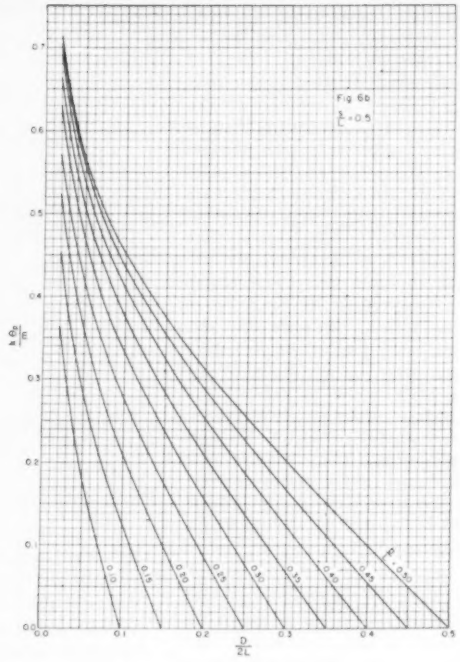
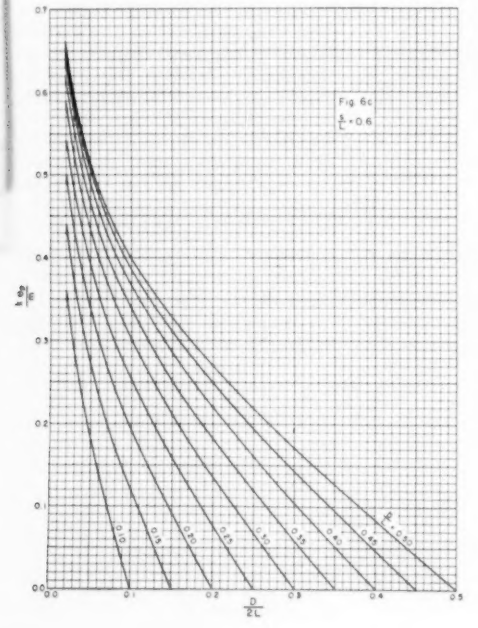
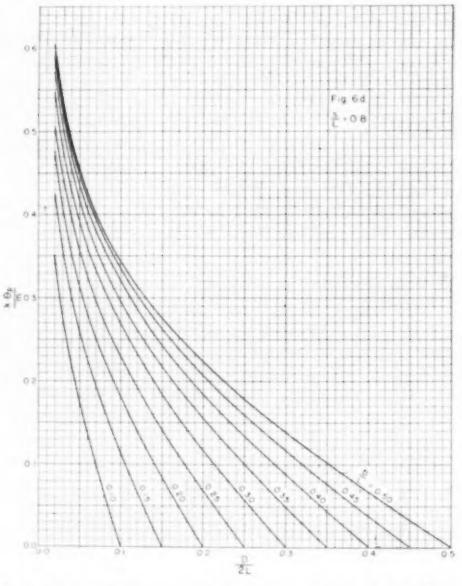



Fig. 5—Schematic illustration of heat flow quantities

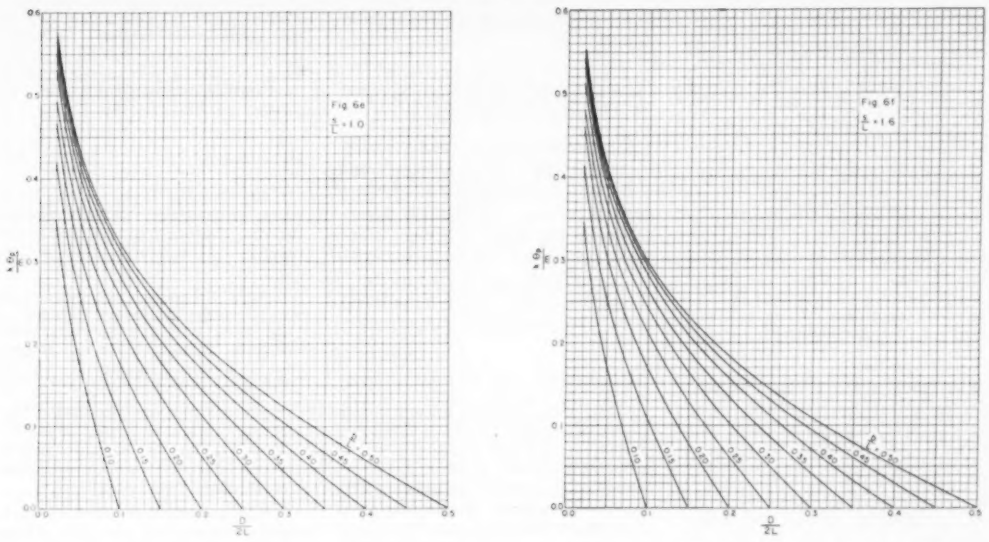



**Figs. 6a to 6d—Relationship between thermal variables and slab geometry, $\left(\frac{k\theta_r}{m}\right)$, $\left(\frac{s}{L}\right)$, $\left(\frac{b}{L}\right)$, $\left(\frac{D}{2L}\right)$ (for values of $s/L$ = 0.4 to 0.8)**




**Figs. 6e and 6f—Relationship between thermal variables and slab geometry, (for values of $s/L$ = 1.0 and 1.6)** $\left(\frac{k\theta_p}{m}\right)$, $\left(\frac{s}{L}\right)$, $\left(\frac{b}{L}\right)$, $\left(\frac{D}{2L}\right)$

ponent referred to the center of the tube.

*Heat Flow Rates*

From the mathematically exact derivation it is established that the division of the *source component* of the heat flow between the two slab surfaces, with reference to Fig. 5, is:

$m\,(1 - b_1/L)$ To the surface at $t_1$
$m\,(1 - b_2/L)$ To the surface at $t_2$

The heat flow rate through either one of the slab surfaces is computed as the sum of a source component and a linear-flow component. Supposing that $t_2 > t_1$, this may be expressed as follows:

$$(q/A)_1 = \left[\ (q/A)_1 + (q/A)_2\ \right]\left[1 - \frac{b_1}{L}\right] + \frac{k\,(t_2 - t_1)}{L},$$

Btu per (hr) (sq ft surface) ..... (4)

The source strength, Btu/per (hour) (linear foot pipe), is related to the total heat flow by the expression

$$\frac{m}{s} = (q/A)_1 + (q/A)_2 \quad \ldots\ldots (5)$$

*where*

$s$ = the pipe centerline spacing.

Expressing Equation 4 per linear foot of pipe,

$$(q/l)_1 = m\left(1 - \frac{b_1}{L}\right) + k\,s\left(\frac{t_2 - t_1}{L}\right),$$

Btu/ (hr) (linear ft pipe) ..... (6)

The subscripts 1 and 2 may be interchanged if desired in Equations 4 and 6.

It must be emphasized again that in application the mean surface temperatures $t_1$ and $t_2$ will find their levels according to the remainder of the thermal circuit outside of the slab.

Although, pending further analytical studies, the suggested limits of Table 1 must remain, calculations of *heat flow* for the case where the pipe is very close to the surface may be made with greater confidence than calculations of *(mean surface) temperature*. The reason for this is that, for most heating applications the heat-flow rate from the surface may be taken as directly proportional to the difference between the surface temperature and an environmental temperature; and with this direct proportionality, surface temperature waves may be replaced by the corresponding mean temperature in computing heat flow on the air side of the surface.

## Experimental Confirmation

As previously indicated, the results of the experimental investigations are summarized in another paper[2]. In this presentation confirmation of the theory given here will be limited to Equation 4.

From the test data obtained in the experimental studies[2] mean surface temperatures and rates of heat flow were determined. By rearranging Equation 4 a check on the theory can be made by plotting

$$\left[1 - \frac{(q/A)_1 - k\,\frac{t_2 - t_1}{L}}{(q/A)_1 + (q/A)_2}\right] \quad \textit{vs.}\ (b_1/L)$$

The comparison of theoretical and experimental data is shown in

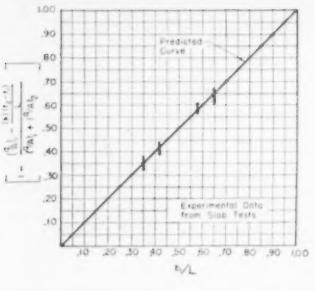



**Fig. 7—Comparison of theory and experiment**

Fig. 7 from which it may be seen that experimental scattering from the theory is relatively small and of the magnitude to be expected in the type of work involved. Hence, the theory is considered to have been confirmed within the limits indicated.

It is of practical importance to note that the heat flow is quite sensitive to the ratio $(b_1/L)$. This means that pipe bury should be held to careful tolerance in construction work if design calculations are to apply accurately.

## Example

A numerical example, duplicating one of the conditions for which test data were taken, will illustrate the use of Equation 3 for calculating pipe temperature. Geometrical factors are: $s = 8$ in., $L = 5.05$ in., $(b_1/L) = 0.416$, $s/L = 1.58$, $D/2L = 0.0865$. Slab thermal conductivity, $k = 1.09$ Btu per (hr) (sq ft) (deg F) (ft). Measured heat flow rates, $(q/A)_1 = 48.0$ and $(q/A)_2 = 3.28$ Btu per (hr) (sq ft). Measured mean surface temperatures, $t_1 = 106.9$ and $t_2 = 114.5$ F.

Compute $m$ from Equation 5,

$$m = (48.0 + 3.28)\left(\frac{8}{12}\right)$$
$$= 34.2 \text{ Btu per (hr) (linear ft)}$$

From Fig. 6,

$$\frac{k\,\theta_p}{m} = 0.306, \text{ or}$$

$$\theta_p = \frac{0.306 \times 34.2}{1.09}$$
$$= 9.60 \text{ F}$$

Compute the pipe temperature from Equation 3,

$$t_p = t_1 + \theta_p + (t_2 - t_1)\ (b_1/L)$$
$$= 106.9 + 9.60 + (7.6)\ (0.416)$$
$$= 106.9 + 9.60 + 3.16 = 119.7 \text{ F}$$

$t_p$ by experiment is 120.6 F which is satisfactory agreement. Numerous other check calculations for test conditions also have yielded agreements in the order of 1 deg. Since the calculations are quite sensitive to uncertainties in $(b_1/L)$ a small dimensional error has a large effect upon the computed temperatures.

## Conclusions

1. Using the source-image principle, a workable analysis has been developed for heat flow in the system of a row of pipes buried within a slab.

2. The analytical predictions have been confirmed by test results as is demonstrated further in another paper[2].

3. The theory can be used for design calculations until such time as more complete practical design data and design methods are available. However, if it is to be used for this purpose, it is essential that the user have a thorough fundamental understanding of the theory.

## References

1. 1947 Annual Report of the Committee on Research. (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, Vol. 20, March 1948, pp. 115-120.)

2. ASHVE Research in Panel Heating and Cooling—Laboratory Studies on Heat Flow Within a Concrete Panel. (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, Vol. 22, April 1950, p. 109.)

3. Electric Analogger Studies on Panels with Imbedded Tubes, by Carl F. Kayan. (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, Vol. 22, May 1950.)

4. Electromagnetic Problems in Electrical Engineering, by B. Hague. Oxford University Press, London, 1929, Chapter 4.)

## INTERNATIONAL JOINT COMMITTEE ON PSYCHROMETRIC DATA TO MEET MAY 6

A meeting of the International Joint Committee on Psychrometric Data will be held at Towne Scientific School, University of Pennsylvania, Philadelphia, on May 6 at 10:00 a.m. daylight saving time. Dr. Baldwin M. Woods, past president of the ASHVE, is chairman of the committee which was formed in 1945 and sponsored by the Society.

The objectives of the Committee are: (*a*) to obtain information regarding the thermodynamic properties of moist air which can claim general acceptance as standard on the ground that it is thermodynamically consistent within the accuracy of existing knowledge; (*b*) to develop specifications of standard instruments for the practical realization of these properties in the field; (*c*) to recommend standard symbols, terminology, and charts calculated to promote a better understanding of underlying theory in its application to practical problems involving moist air.

Immediate objectives for the coming meeting will be to secure agreement regarding acceptable definitions for saturation, partial pressures, relative humidity, and humidity ratio at saturation.

Proposed definitions for consideration will be:

1. That saturation refer to the condition in which two or more distinct thermally homogeneous phases can coexist in natural equilibrium across one or more relatively flat surfaces of separation. Each co-existing phase (not the space occupied by it) is said to be saturated with respect to the others. Moist air is the vapor phase of the air water vapor system.

2. That partial pressures be the molfraction times observed pressure.

3. That relative humidity be the ratio of humidity ratios.

4. That saturation at temperatures below 32 F is understood to be with respect to undercooled liquid in defining thermodynamic wet bulb and thermodynamic dewpoint temperatures.

The committee personnel will be found on page 139.

# Surface Temperatures of Plaster Ceiling Panels

By Sidney Becker*, Montreal, Que., Canada

**SUMMARY — The surface temperatures of a plaster panel containing ¾-in. pipes on 7-in. centers, with water circulating at 119 F, were obtained at equilibrium conditions for four arrangements of insulation at the back of a panel. Imbedding of the pipes in plaster as compared with exposure of pipes on the back of a panel reduced temperature variation at the surface by 10 deg. Temperature differences between various points on the panel surface varied from 26-12 deg, depending on the insulation used behind the panel.**

AN IDEAL ceiling panel for a panel heating system would have a uniform temperature over its entire area. Such uniformity is difficult to achieve at present for various reasons; the principal reasons being that: (1) the panels must be incorporated in buildings without interfering with the rest of the construction, (2) they must be economical in cost and therefore, easy to build, (3) they must be durable, and (4) they must suit the interior treatment of the room.

The most commonly used type of ceiling panel is made by imbedding a pipe coil in plaster which acts as a heat conductor to create a large warm surface area. A plaster panel was therefore used in this investigation and tests were conducted with various types of insulation placed behind the panel.

## Object of Tests

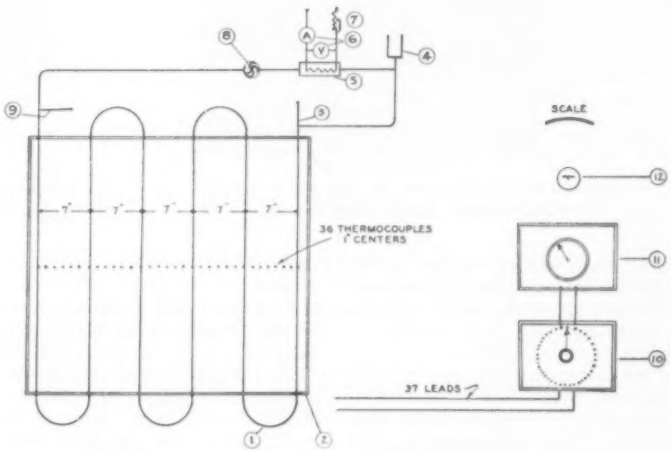
The object of the investigation was to determine:

1. Effectiveness of the plaster in creating a large warm panel and the temperature variations across the surface of the panel.
2. Effect of different methods of insulating the back of the panel in reducing variation of panel surface temperature.
3. Effect of completely imbedding the coil in plaster in reducing the variation of panel surface temperature.
4. Nature of the heat lag or warming up time of a plastered panel.

## Arrangement for Tests

The test panel comprised a sinuous coil made of seven pieces of ¾-in. black standard weight wrought-steel butt-weld pipe on 7-in. centers, about 5 ft long. Wire lath was tied to the bottom of the coil by means of soft iron wire. Two rough coats and a finish coat of white plaster were applied to the wire lath in a conventional manner to provide a ½-in. thickness of plaster beneath the pipes.

In one test (Fig. 5) the plaster was applied to the back of the panel between the pipes and back of the




1. Pipe Coil
2. Plaster Panel
3. Temperature, Outlet Water
4. Expansion Tank
5. Electric Water Heater
6. Voltmeter and Ammeter
7. Rheostat
8. Circulating Pump
9. Temperature, Inlet Water
10. Thermocouple Selector Switch
11. Potentiometer
12. Galvanometer

**Fig. 1—Schematic arrangement of test equipment**

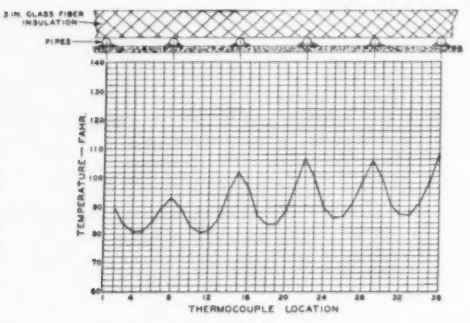
*B. Eng. (McGill); Member *EIC*; P. Eng. Member of ASHVE. Investigation made at McGill University Laboratory, 1945 while acting as demonstrator in mechanical engineering.

For presentation at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Ontario, Canada, June 1950.

pipes so that the pipes were completely imbedded in 2 in. of plaster.

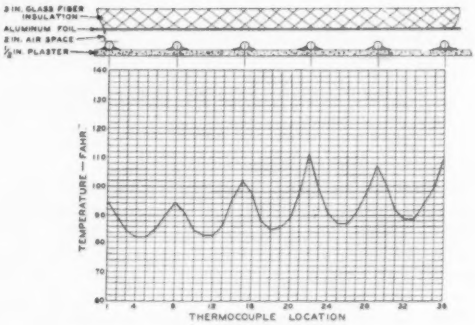
When the plaster was thoroughly dried 36 copper-constantan thermocouples made of No. 36 B & S gage wire were imbedded 1 in. apart in the face of the finished plaster. in a horizontal position on a frame made of 2-in. × 4-in. spruce lumber. The pipe coil was connected in series with a 1000 watt electric water heater and a circulating pump. An ammeter and voltmeter were used to indicate the current flow being intended to increase the rate of heat transmission from the pipe wall to the panel surface.

A method of insulating the back of the coil to reduce the heat loss from the back of the plastered panel is shown in Fig. 2. Fig. 3 shows a



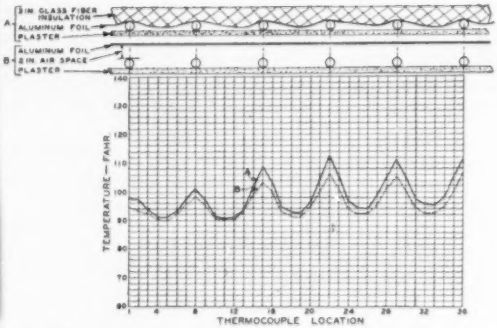

(3-in. glass fiber insulation)

**Fig. 2—Panel surface temperatures**



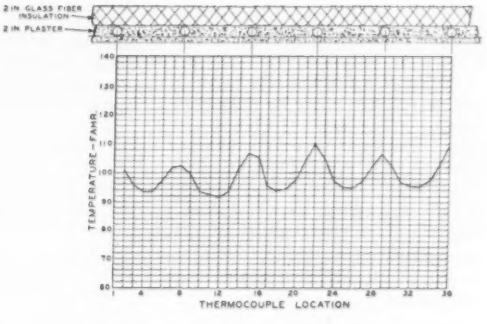

(3-in. glass fiber insulation and aluminum foil)

**Fig. 3—Panel surface temperatures**




(aluminum foil with and without 3-in. glass fiber insulation)

**Fig. 4—Panel surface temperatures**




(imbedded coil and 3-in. glass fiber insulation)

**Fig. 5—Panel surface temperatures**

This was done by making a fine scratch in the surface of the white plaster, imbedding each thermocouple junction, and covering it with plaster of Paris.

Each thermocouple and its cold junction were connected through a selector switch arrangement to a high-precision potentiometer. The location of the thermocouples in a line on the surface of the panel, and a schematic arrangement of the test equipment are shown in Fig. 1.

The finished panel was supported and potential through the electric heater.

A strap-on type of surface thermostat attached to the pipe on the inlet side of the coil controlled the electric heater to maintain a constant inlet water temperature. Thermometers were inserted in wells on the inlet and outlet sides of the coil. Panel surface temperatures were obtained for equilibrium conditions.

Five different methods of reducing variation in panel surface temperatures were used, each method

method of insulating the back of the coil to increase the radiant heat transfer from the back of the pipe to the back of the plaster surfaces between pipes, and thus reduce the temperature gradients between pipes. Two methods of insulating the back of the coil are given in Fig. 4. Method A increases the radiant heat transfer, and also reduces the heat loss from the back of the coil and plastered surfaces, and method B is used for the sole purpose of re-radiating heat from the back or unimbedded surface of

the pipe coil to the adjacent plaster surfaces. The relative effectiveness of methods A and B is shown by the curves plotted in Fig. 4.

Fig. 5 shows the coil completely imbedded in plaster and consequently heat is transferred by conduction through the plaster. The back of the panel is insulated to reduce heat loss from the back.

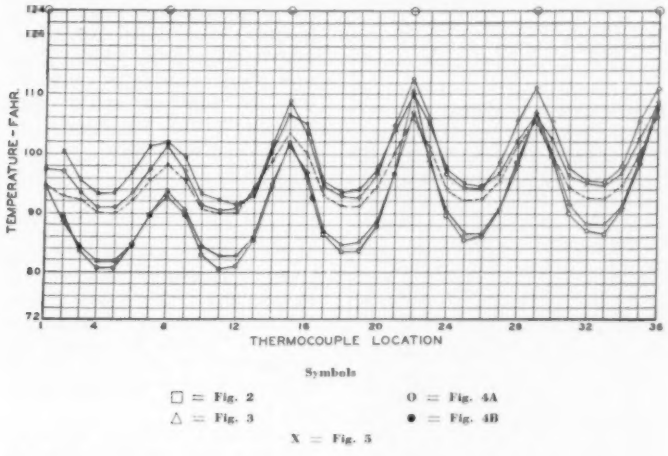



**Fig. 6—Comparison of panel surface temperature for five panel arrangements**

## Test Results

The panel surface temperatures at equilibrium are shown in curves plotted (Figs. 2, 3, 4 and 5) for the different methods of insulating the back of the pipe coil and for the totally imbedded pipe coil.

Fig. 6 shows data from Figs. 2 to 5 plotted on a larger scale and on a single chart for purposes of comparison.

In addition to the results shown, readings were also taken to establish the time required for temperatures to become constant. These indicated that thermocouples located directly over pipes reached a steady temperature in about 10 to 15 min while those between pipes attained steady temperatures in approximately 25 to 30 min.

The electric input to the water heater was obtained in the tests but can not be considered of any value in determining the heat output from the panel surface, due to the many indeterminate losses through the ends and back of panel and from the exposed ends of the pipe coil. However, as a matter of interest, when operating at steady conditions, the input was 4.0 amp d-c at 110 volts which would indicate a gross heat loss of approximately 110 Btu per (hr) (sq ft of panel surface).

## Conclusions

The following conclusions were drawn from the tests results for the conditions given:

1. Temperature variations at the panel surface are from 26 to 12 deg, depending on the method of insulation.

2. Panel surface temperature variations can be reduced approximately 10 deg by proper insulation.

3. Effect of imbedding the coil completely in the plaster is to reduce the temperature variation approximately 10 deg.

4. Heat lag in the coolest part of the panel surface does not exceed 20 to 25 min.

5. Based on results obtained, the type of panel tested is effective for creating a large warm surface area, in spite of the temperature variations.

6. Although temperature variations are reduced by imbedding the coil, the improvement in surface temperature obtained does not seem to justify the additional expense involved.

## Acknowledgment

The author wishes to acknowledge the assistance given by the late R. H. Patten, associate professor, Mechanical Engineering Department, McGill University, who rendered advice on and guided the set-up and procedure used in this investigation.

## John R. Allen Memorial Library

The ASHVE Committee on Research gratefully acknowledges the following gift to the John R. Allen Memorial Library, which is maintained at the Society's Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

*Dust Control in Mines*, by National Coal Board. London, England. Gift of National Coal Board.

The presentation of textbooks and pamphlets in the field of heating, ventilating, and air conditioning and allied fields, by authors and others, will be welcomed by this library. Suitable book plates carry the name of the donor and date of the gift.

## PRESIDENT'S LETTER

Dear Fellow Members in ASHVE:

Remember in our early school days how we looked for the common denominator? Well it seems to me I've found the common denominator which makes this Engineering Society—THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—different from other Societies.

That common denominator is the evangelistic zeal with which so many of our members promote the activities of the chapters and the Society. I know of no other organization where professors, consulting engineers, industrial hygienists, manufacturers and their representatives, contractors, physiologists, architects and just plain engineers join together in exchanging information, conduct and interpret research and promote the better practices in their engineering field. This common denominator, this factor, this characteristic, is in my opinion the reason for our growth and strength, and as we recognize it so must we cherish it.

I say this after having visited and spoken with some 25 chapters during the past four years including recent visits to North Carolina, Washington, D.C., Baltimore, Toronto, Dallas, Los Angeles, San Francisco, Portland, Seattle and Salt Lake City. I'm proud of the high calibre of the members of these chapters and am amazed at the enthusiasm the present and past officers have for their chapter and the society in general. There is something about the men joined in this activity that makes the stranger feel at home wherever he meets a member of ASHVE. Truly it's a great organization for which we all can be proud to work.

This brings up the question of our growth and the direction it must take. It seems to me that we have come of age in our thinking that we are devoted to improving arts and sciences in the interest of the general public. Our membership must be open to all engineers who want to join in this activity. We should form chapters in those cities where we have present members and potentialities for growth of the same type we have had in present chapters.

We should open a special branch serving certain industries, cities or interests. We can establish student branches in some educational institutions where they will be nurtured and needled to continue active although their membership must necessarily turn over almost completely each year.

Possibly we should consider further extending our activities in the international field of heating, ventilating and air conditioning. We deal with life forces and influences and these know no geographical boundaries. Certainly in the English speaking sections of the world we have many members—England, Egypt, India, Mexico, Australia, South Africa. We can help to extend the knowledge and skills we have here by a broader distribution of publications. Possibly branches could be encouraged in London, Mexico, D.F., Cairo, and Buenos Aires, to name a few cities in foreign lands where we have at present a number of members and they would find, as we have here, where "two or three are gathered together" this common denominator takes over and then you have 25 - 50 - 100 - 150 joined together in these stronger groups, branches of ASHVE.

Good luck and happiness to each of you—all over the world, wherever you may be.

Sincerely yours,

LESTER T. AVERY, *President*

## 28TH EDITION OF GUIDE PUBLISHED

The 1950 edition of the HEATING, VENTILATING, AIR CONDITIONING GUIDE will be ready for distribution to members this month. Forty-four pages of text have been added to the Technical Data Section which now comprises 1024 pages of the HEATING, VENTILATING, AIR CONDITIONING GUIDE 1950. Twelve pages were made available by condensation, rearrangement and revision, and the balance was obtained by lengthening the section.

For most convenient reference to closely related material, the 50 chapters of Technical Data have been rearranged in seven groups: Section I, Fundamentals; Section II, Human Reactions; Section III, Heating and Cooling Loads; Section IV, Combustion and Consumption of Fuels; Section V, Systems and Equipment; Section VI, Special Systems; Section VII, Instruments and Codes.

A thorough revision of THE GUIDE has been made possible by the cooperation of 34 engineers and other authorities who have assisted the Guide Publication Committee in collecting and compiling latest information on current practice in the field of heating, ventilating and air conditioning. A review of the new edition shows many major improvements, some of which are mentioned briefly in the following paragraphs.

The ASHVE Comfort Chart in the chapter on Physiological Principles has been revised to agree with information obtained from most recent ASHVE and cooperative research. The information resulting in a change of the Comfort Chart is discussed in the chapter.

Data on effect of high temperature and humidity on individuals in hospitals, and a discussion of air sanitation, have been added to the chapter on Air Conditioning in the Prevention and Treatment of Disease.

The tables showing permissible limits of air contaminants in the chapter on Air Contaminants have been brought up to date with the latest recommendations of the *American Standards Association*

and the *American Conference of Governmental Industrial Hygienists*. The number of contaminants listed has been increased.

Air leakage and natural ventilation are treated in the chapter, Infiltration and Ventilation. A section has been added on ventilation of animal shelters, showing requirements for dairy stables, sheep and swine barns, and poultry-laying houses. Instructions for determining proper ventilating facilities are given.

The chapter on Heating Load has been enlarged by the addition of a section on floor heat losses in basementless houses. A formula is given for computation of heat loss from the perimeter of various types of typical floors in basementless houses.

The chapter on Fuels and Combustion includes new data on fuel specifications. The latest anthracite sizing specifications are given. Typical gas analyses are listed for an increased number of present-day fuel gases. New fuel oil specifications, grades and calorific values are given. The number of formulas for combustion computations has been increased, and charts have been added for determining flue gas loss for manufactured and natural gas.

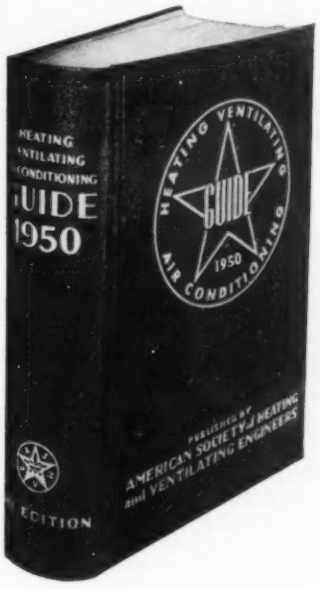
Rating formulas for forced warm air furnaces have been added to the chapter on Heating Boilers, Furnaces, Space Heaters. Recent developments in rating and performance of solid fuel burning space heaters are outlined.

In the chapter on Chimneys and Draft Calculations the information on domestic chimney performance and selection has been extended. Test data for small chimneys have been added, and new charts are provided for selection of small chimneys. Several new types of chimney construction are described.

Tables of bonnet and register temperature, and register delivery volume, which are included in the chapter on Mechanical Warm Air Systems, have been revised to include latest changes made by the *National Warm Air Heating and Air Conditioning Association*.

In the chapter on Hot Water Heating Systems and Piping, latest *ASME* Boiler Code requirements for relief valves, expansion tanks and connections, are listed. A new table shows *ASME* requirements for sizing of closed expansion tanks.

Convector descriptions and rating information have been coordinated with definitions and rating practice current in the industry, and are given in the chapter on Radiators and Convectors. Ratings are also given for cast-iron radiant baseboards. The chapter also includes new tables showing accepted ratings of column type, large tube type and wall type cast-iron radiators.




In the chapter on Air Duct Design, two air friction charts having ranges 10 to 2000 cfm, and 1000 to 100,000 cfm replace the previous single chart. A separate enlarged print of these charts is included in the envelope in the back of the book, and copies of the enlarged charts may also be obtained from the Society. The section on the static regain method of duct design has been expanded, two charts facilitating use of the static regain method have been added, and the method is illustrated by means of examples. The chapter also contains a section on the use of aluminum for ducts.

The chapter on Fans has been rewritten to include much new material and to amplify the discussion of various types of fans. Latest acceptable designations and nomenclature for fan drives and motor positions are given. The section on fan selection and application has been enlarged.

The information on performance, as well as construction of coils, has been combined in one chapter entitled Air Heating and Cooling Coils.

The chapter on Refrigeration includes new material on controls and refrigerant piping. Revisions have been made in the sections on air cycle and absorption systems. Improved descriptions of accessories have been included.

The chapter on Motors and Motor Controls now includes a new section on fundamentals of motor selection and several applications of various types of systems. New tables show recommended horsepower limits, preferred voltages and speed ranges for various motors and systems.

The chapter on Sound Controls has been almost entirely rewritten to cover the fundamentals of sound determination and measurement. Information on acceptable sound levels in various types of space has been added. Typical sound level characteristics of fans are shown on new charts. Practical methods of reducing undesirable sound are explained.

The chapter on Industrial Air Conditioning has been rewritten to cover a wider application of air conditioning in the industrial field. Temperatures and humidities for various applications have been brought up to date with current operating conditions.

The theory of drying, including fundamental equations for drying operations, is treated in a rewritten and expanded chapter on Drying Systems. Practical drying operations and dryer types are described.

The chapter on Transportation Air Conditioning combines the

former chapter of the same name with the former chapter on Marine Heating, Ventilating and Air Conditioning. Conditions required in various types of shipboard space have been revised to agree with results of recent developments.

In the chapter on Water Services, new data and tables have been added to supplement previous data. Capacities of various fixtures and methods of estimating flow have been added. The equivalent length of various fixtures, fittings and devices is shown in new tables. A section on safety devices has been added.

New references to methods of determining air contaminants and methods of obtaining samples are mentioned in the chapter on Instruments and Measurements.

Many new Codes and Standards of interest to the heating, ventilating and air conditioning engineer have been added to the previous list in the chapter, Codes and Standards. Latest editions of the Codes are indicated. Addresses of organizations sponsoring the Codes and Standards have been brought up to date.

A ready reference to the information in the Technical Data Section is provided by an extensive cross-index.

The 1950 Edition of THE GUIDE was prepared under the supervision of the ASHVE Guide Publication Committee composed of W. N. Witheridge, *Chairman;* A. B. Algren, R. P. Cook, Nathaniel Glickman, P. B. Gordon, E. F. Hyde, H. R. Limbacher, P. J. Marschall, Clifford Strock, Cyril Tasker, *Ex-Officio;* and Carl H. Flink, *Technical Secretary.*

Convenient reference to prominent manufacturers and their latest products available for use in heating, ventilating and air conditioning systems, is provided by the Manufacturers' Catalog Data Section which also includes a cross-index. Available equipment is listed under a variety of headings in the cross-index.

The 28th Edition of THE GUIDE contains 1420 pages, of which 1024 are used for the Technical Data Section, and 396 are used for the Manufacturers' Catalog Data Section.

In color and appearance, the Guide is similar to the previous edition, except for the increase in thickness made necessary by the expansion of the Technical Data and Catalog Sections. Size is 6 × 9 inches, and the book is bound in blue cloth cover, stamped in gold. The price of THE GUIDE is $7.50.

## ASHVE MEMBERS APPOINTED REPRESENTATIVES

The following members of The ASHVE have been appointed district representatives for Kritzer Radiant Coils, covering territories as follows:

F. E. Prawl, general manager, Prawl Engineering Corp., with headquarters in Omaha, Nebr., and covering state of Nebraska and far western Iowa.

A. A. Aiken, secretary-treasurer of AAA Engineering Sales Co., with headquarters in Lansing, Mich., and covering the state of Michigan.

W. B. Schuler with headquarters in Rock Island, Ill., and covering western Illinois and eastern Iowa.

Another appointment announced by Kritzer Radiant Coils is that of M. M. Berger of M. M. Berger and Associates, with headquarters in Cleveland, Ohio, and covering the northern part of Ohio and northwestern Pennsylvania.

## MEMBERS IN FRANCE ATTEND DINNER

Twelve ASHVE members in the vicinity of Paris held a dinner at the Maison des Centraux, Paris, on the evening of January 26, 1950, for the purpose of enabling members in France to become better acquainted with each other. Arrangements for the dinner were made by Life Member, Auguste Beaurrienne, and member, E. P. Jouanno. Other members present were: Roland Bollaert, who had just returned after spending three years in the U.S.A., M. E. Cartier, Andre Desplanches, Fernand Ghillardi, P. R. Marchal, Rene Modiano, Andre Nessi, Hippolyte Parodi, F. J. Pratt, and P. M. A. Touzard.

The idea for the dinner was the result of contacts made with members by Mr. Pratt, ASHVE member, now in Paris as chief of the Mission Liaison Section, Labor Division, Office of the Special Representative, ECA. Mr. Pratt gave a word of greeting from American members and outlined his work in connection with the Marshall Plan, his talk being translated into French by Mr. Beaurrienne.

For the purpose of effecting an informal organization, the following were elected: *President*—Auguste Beaurrienne, *Secretary*—Roland Bollaert, and *Treasurer*—E. P. Jouanno.

The members present felt that a permanent organization should be formed, but since there were apparently not enough members at the present time to permit formation of a chapter, it was decided to obtain advice from THE ASHVE regarding the type of organization which might provide, for members in France, benefits similar to those derived from Society chapters.

The secretary was instructed to convey the greetings of the members present to THE ASHVE and during the meeting, the members discussed the possibility of holding a larger meeting to which all European members of ASHVE would be invited. It was also suggested that any members who might be traveling in Europe should communicate with the secretary, Mr. Roland Bollaert, Laboratoire d'Etudes Thermiques, 12 rue des Bateliers, Clichy (Seine) France.

## SOCIETY OFFICERS MAKE SPRING TRIPS

Pres. Lester T. Avery will talk on Dynamic Air Conditioning at meetings of the Philadelphia and New York Chapters on April 13th and 17th respectively, and he will visit the Illinois Chapter (Chicago) and Wisconsin Chapter (Milwaukee) on May 8th and 9th.

First Vice Pres. L. E. Seeley is scheduled to address the Atlanta Chapter on April 10th and Delta Chapter (New Orleans) April 11th. His subject will be Is Humidity Control Important for the Air We Breathe?

Royal Muskoka Hotel, Ontario, Canada

# AHOY! MUSKOKA

## ASHVE Semi-Annual Meeting

**June 19-21, 1950**

The Royal Muskoka Hotel, Ontario, Canada, will be the headquarters for the 1950 Semi-Annual Meeting, June 19-21, and the Ontario Chapter will be host for the occasion. John H. Fox, general chairman of the Committee on Arrangements, has announced that plans are in their final stages to welcome ASHVE members and guests.

A fine technical program is being planned by the Program and Papers Committee for the three-day meeting. Technical sessions are being planned and timed to permit members to take part in the social program as well. Of course, the ladies will not be forgotten and will be well taken care of while their husbands busy themselves as "Btu Bugs."

The Royal Muskoka is one of the better known Ontario summer resort hotels and is located in the Muskoka Lakes district, a part of what is known as the *Highlands of Ontario*. The hotel is easily reached by road or a combination rail and boat route. It is located about 125 miles directly north of Toronto, with Ontario Highway, Route 11, north from Toronto to Gravenhurst insuring good motoring.

For the convenience of the train travellers, special Canadian National Railway connections to boats at Muskoka Wharf are being arranged. Arrangements for reception of those travelling by air direct to Muskoka will be announced in later bulletins to members.

There will be boat trips, golf, and plenty of opportunity to enjoy swimming, fishing or sightseeing in this part of Canada which is famous for its natural beauty. The latter part of June is an ideal time to plan a family vacation, and with the young folks just out of school, they can be included in your plans. A children's program is being planned by the Committee so that they too will enjoy a visit at the Royal Muskoka. Beach parties and dancing are added features of the program.

A speaker who is known to international audiences will address the Banquet which is scheduled for Tuesday evening.

## COMMITTEE ON ARRANGEMENTS

John H. Fox, *General Chairman*
A. J. Strain, *Vice Chairman*
H. R. Roth, *Secretary*

**Committee Chairmen**

*Banquet*.....D. A. Stott
*Entertainment*.....E. G. Spall
*Finance*.....H. D. Henion
*Ladies*.....W. W. Miller
*Publicity*.....N. W. Kingsland
*Reception*.....G. P. Cooper
*Sessions*.....William Philip
*Special Events*.....G. S. McKernan
*Sports*.....R. H. Lock
*Transportation*.....W. H. Evans

By the way, no *passports* are necessary for entry into Canada or Ontario. The Ontario Chapter and The Royal Muskoka are at your service.

# Summary of Chapter Meetings*

• **ATLANTA** — February 13, 1950. The Atlanta Chapter joined with the *ASRE* Georgia Section in a meeting held at Harris' Tea Room. W. M. Garrad, president of ASHVE Chapter, called the meeting to order and the reading of minutes was dispensed with by both groups. Following the introduction of the local officers of both groups, Paul Weir, general manager of Atlanta Water Works, gave a few introductory remarks before the speaker of the evening, H. E. Degler, technical director of Marley Co., Inc., Kansas City, Kans., was introduced.

Mr. Degler gave an interesting discussion on the subject of *Water Cooling Towers,* and by the use of slides established a basis for evaluating cooling tower performance, from the standpoint of both water consumption and water cooling capacity, along with a dollars and cents appraisal of value. An open forum period followed. Attendance 86.

• **BALTIMORE** — February 7, 1950. Pres. E. L. Crosby opened the meeting with a report on the preceding Board of Governors' meeting, followed by a report on the Society's recent Annual Meeting in Dallas. President Crosby then introduced the speaker, Prof. E. R. Queer, professor of engineering research, Pennsylvania State College, State College, Pa., who delivered an address on *The World Is Sopping Wet.*

Professor Queer's talk described the climatic conditions regulating humidity in the air and the transfer of water from the oceans to the land through cloud formations. He outlined in some detail the effect of these humidities on building structures of various types. With slides and illustrations, he described the methods used at Penn State Experimental Station in investigating and tabulating the effects of varying outdoor humidities on different types of building structures within their climate chamber. An extensive discussion followed Professor Queer's address. Attendance 46. Attendance ratio 0.53.

• **CENTRAL NEW YORK**—February 8, 1950. After dinner at Howard Johnson's Restaurant, members and guests were called upon to rise and introduce themselves and it was noted that a number of states were represented among the guests. Brief reports were given by the treasurer and secretary, and following a few announcements A. C. Bailey, water development engineer at Kodak Park Works, Eastman Kodak Co., Rochester, N. Y., was introduced. Mr. Bailey, consultant to other divisions of the Kodak Co. on water, spoke on *Water—Its Sources, Availability and Treatment,* which was timely and of importance to those people who are participants in the air conditioning and refrigeration industry.

His handling of this complex subject in a relatively short time was excellent. Mr. Bailey discussed water problems relating to boilers, industrial processes, and air conditioning apparatus. In addition, he emphasized the need for water conservation. Many municipalities are finding it necessary to impose strict ordinances in order to extend their short supplies of water. Many questions were asked at the conclusion of Mr. Bailey's interesting talk, most of which were in reference to water treatment for boilers and closed water systems. The discussion continued until after 10:00 p.m. Attendance 51.

• **CINCINNATI** — February 7, 1950. Engineering Society Headquarters was the meeting place for the February meeting, presided over by Pres. K. B. Little. President Little invited all those who had attended the Annual Meeting in Dallas to report briefly on the activities. Remarks were made by Messrs. Bechtol, Edwards, Gerdsen, Junker, Leupold, McNamee, Motz, Sproull and Sutfin. A. W. Edwards reported on the meetings of the Chapter Delegates and H. E. Sproull reported as a member of the Society's Council.

President Little added a few remarks of his own on the Dallas Meeting and introduced John E. Haines, a member of the Society's Council and chairman of its Chapter Relations Committee, and vice president of Minneapolis-Honeywell Regulator Co., Minneapolis. An authority in the heating and air conditioning industry, Mr. Haines spoke on the *Latest Advancements in Solar Heating and Its Control.* After a lengthy discussion period, the meeting adjourned. Attendance 57. Attendance ratio 0.33.

• **DELTA**—January 14, 1950. The Delta Chapter held a joint meeting with the New Orleans Section of ASRE in conjunction with the annual meeting of the *Louisiana Engineering Society* at the St. Charles Hotel, New Orleans. Presiding at the

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

meeting were R. B. Guest, president of the Delta Chapter, and Carroll Crawford, president of the New Orleans Section of *ASRE*. L. V. Cressy of the Delta Chapter introduced the speaker, Walter Cooke, manufacturers' representative, who spoke on the subject *The Steam Turbine for Driving Turbo Compressors*. Mr. Cooke's talk, which was both interesting and informative, was thoroughly enjoyed by all the members and many questions were asked before the meeting adjourned.

• **GOLDEN GATE**—The Golden Gate Chapter of the ASHVE announces the following Committees and Committee personnel for the year 1950: *Attendance*—F. W. Jordan, *Chairman*, H. L. Duncan, J. R. Kelahan, Jr.; *Finances*—H. R. Scandrett, *Chairman*, James Gayner, M. E. Harrison, W. L. Breyer, T. J. White; *Legislation*—C. H. Bazille, *Chairman; Membership*—T. A. Marshall, *Chairman*, J. I. Sprott, S. W. Terry, C. D. Williams, R. B. Holland; *Publicity*—J. S. Rose, *Chairman*, J. C. Hemingway, Jr., D. R. Dickson; *Program*—R. C. Cushing, *Chairman*, W. F. O'Keeffe, Jr., D. H. Gray, Jr.; *Constitution and By-Laws*—F. W. Kolb, *Chairman*, N. H. Peterson, P. B. Beggs, A. J. Bouey, N. W. Downes; *Reception* — T. C. Douglass, Jr., *Chairman*, M. J. Kodmur, E. F. Dill, K. C. Mirov, A. L. Fluharty; *Technical*—J. E. Murray, *Chairman*, E. L. Kelly, R. S. Ash.

• **ILLINOIS** — February 13, 1950. Pres. J. S. Kearney opened the meeting with a report on the Proceedings of the Dallas Meeting, announcing that 60 Chicago members attended the meeting, along with 26 wives and about 36 guests registered from the Chicago area. He concluded his report with remarks concerning the activities of the Chapters' Conference Committee and a discussion on the new By-Laws. H. E. Anderson introduced a number of new chapter members, followed by the introduction of out-of-town guests. The meeting chairmen, A. H. Blaker, G. G. Freyder and V. L. Wesby, took over the meeting and three leading consulting engineers of Chicago were introduced and ably described *Consulting Engineers' Experiences*.

A wide range of subjects, such as fan installations and problems concerning fans, air duct problems, street lighting, stack design, etc., were covered. Turbine installation, coil freezing, duct oxidation due to air pollution, were other interesting aspects of the meeting. From reports from the Chapter, the subject and speakers made this meeting one of the most interesting of the Illinois Chapter meetings. Attendance 157. Attendance ratio 0.25.

• **KANSAS CITY**—January 9, 1950. Henry Nottberg, Jr. presided at the meeting in the Aladdin Hotel Roof Garden. Following comments on items of Chapter business, J. W. May, technical director, American Air Filter Co., Louisville, Ky., gave a most interesting presentation on his subject *Theory and Operation of Electrostatic Air Filters*, which was highly technical and thoroughly enjoyed. Attendance 64.

• **MANITOBA** — January 19, 1950. The members met at the Fort Garry Hotel, Winnipeg, for their monthly meeting. In the absence of the president, C. M. Fleming presided. Secretary Fleming introduced Art Wrighton of Manitoba Power Commission, who gave an enlightening talk on *Farm Electrification Aspects of Heating and Ventilating*. Mr. Wrighton also discussed the progress that is being made in electrifying Manitoba farms and the future plans. There was considerable discussion regarding the sources of power to make up for the developing shortage of new power sites available to the City of Winnipeg.

The light attendance can be attributed to three factors, the absence of some members who were attending the Annual Meeting in Dallas, several who were on business in Eastern Canada, and the weather with a temperature of 50 below zero. The secretary reported, however, that the waiter was ready with hot toddies to thaw out those who arrived and the seven members and three guests enjoyed an interesting and instructive evening. Attendance 10. Attendance ratio 0.19.

• **MEMPHIS**—January 16, 1950. The regular meeting was held at the King Cotton Hotel wtih Pres. W. E. Wellford in charge. Due to the number of guests in attendance, it was decided to omit all business for the evening and the meeting was turned over to Carl S. Fischer, meetings committee chairman.

E. C. Decker, Carrier Corp., St. Louis office, was introduced and gave an outline of the factors entering into design and operation of the absorption system of refrigeration. Following his talk, Mr. Decker devoted considerable time to answering questions from the floor. President Wellford thanked him for addressing the Memphis Chapter, and the meeting adjourned. Attendance 43. Attendance ratio 0.49.

• **MICHIGAN** — January 16, 1950. Members and guests met in the auditorium of the Detroit Edison Co., Detroit, and the Central Heating Department acted as host for the occasion. This was the 20th year that the company has acted as host to the Michigan Chapter for a meeting and this one came up to the expectations of all present. Following dinner, movies dealing with sporting events were shown and enjoyed, and then the meeting was called to order. Pres. L. A. Burch expressed the Chapter's appreciation to the Central Heating Department for its hospitality.

Vice Pres. C. F. Donohue explained the plans for the evening and outlined the program for the coming season. He then introduced E. E. Dubry, superintendent of the Central Heating Department, who welcomed the members and guests and related a few experiences he had had at former meetings. He introduced A. S. Griswold, staff engineer of the department, who presented a very interesting paper on *European*

*Developments Under the Economic Cooperation Administration.* After an enlightening discussion, the meeting was opened for a question and answer period, which was followed by a feature movie. The meeting was adjourned at 11:00 p.m. Attendance 200.

• **MINNESOTA** — January 9, 1950. The Minnesota Chapter and the Twin Cities Section of *ASRE* held a joint meeting at the Curtis Hotel, Minneapolis. C. J. Otterholm of the *ASRE* was introduced and he in turn called on Prof. A. B. Algren, professor of heating, ventilating and air conditioning, University of Minnesota, to act as moderator for the meeting. The speakers were Messrs. H. R. Gardner, R. Evans and R. T. Murphy.

Mr. Evans gave a splendid talk on the air conditioning installation in Donaldson's Store in which well water was used as a medium. Mr. Gardner discussed two-stage temperature control of food storage at Northwest Airlines. This system was used to freeze prepared food for transport to distant airline stations. Mr. Murphy gave a description of a mechanical air conditioning system at the St. Paul Fire and Marine Insurance Co. Bldg.

Mr. Otterholm added a few comments giving a description of the cooling installation at the Paramount Pictures offices in Minneapolis. Professor Algren closed the meeting at 9:25 p.m.

• **MONTREAL** — January 16, 1950. Pres. S. W. Salter presided at the January meeting held at the Berkeley Hotel. He announced the appointment of the nominating committee as follows: Leo Garneau, A. B. Madden and F. G. Phipps. R. S. Libby reported on the progress made on organizing a technical library for the Montreal Chapter and it was suggested, and unanimously approved, that a library committee be appointed.

D. L. Lindsay introduced the speakers for the symposium on *Fuel Oil and Fuel Oil Burners,* Messrs. Richard Ward, Ralph Grossman, L. Martin and Ivor Roach. J. P. Fitzsimons thanked the speakers on behalf of the Chapter and the meeting was adjourned. Attendance 73.

• **NEBRASKA** — January 10, 1950. Pres. C. A. Carter in opening the meeting asked for more active participation of committee members and encouraged better attendance of members at monthly meetings. V. Dale Wissmiller, supervisor, Minneapolis-Honeywell Regulator Co., delivered a talk on *Heating and Air Conditioning of Transportation Equipment.* His talk covered the cooling and heating in railroad passenger and pullman cars. Attendance 32. Attendance ratio 0.32.

• **NORTH CAROLINA**—January 13, 1950. The North Carolina Chapter met at Bliss Restaurant in Greensboro, and the first order of business was the election of officers. The candidates proposed by the nominating committee were elected as follows: *President*—M. F. DuChateau; *Vice President*—R. O. McGary; *Secretary-Treasurer* — G. B. Rottman; *Board of Governors*—R. B. Crosland, Jr. and F. J. Reed. The gavel was turned over to the incoming president, Mr. DuChateau, who directed the remainder of the evening's program.

T. C. Cooke, consulting engineer of Durham and guest speaker of the evening, delivered an interesting talk on *Forced Hot Water Heat for Larger Buildings.* A short discussion period followed. Attendance 65.

• **NORTH TEXAS**—January 16, 1950. Pres. Herman Blum opened the meeting and before getting down to the business of the meeting, C. R. Gardner introduced C. F. Roth and E. K. Stevens, of the International Exposition Co. in New York, who had arrived in town to prepare for the opening of the Southwest Air Conditioning Exposition at the State Fairgrounds.

Ross Zumwalt presented a detailed report for the auditing committee. L. S. Gilbert then presented C. R. Gardner with an engraved watch in appreciation for his services as general chairman for the Annual Meeting.

The meeting was turned over to Mr. Gardner who expressed his gratitude and then gave a thorough account of the plans for the Annual Meeting. The meeting adjourned at 11:00 p.m. Attendance 102.

• **NORTHEASTERN OKLAHOMA** — February 14, 1950. The meeting was called to order by Pres. A. D. Holmes at Smith's Restaurant. R. F. Shoemaker gave a report on the activities as a Chapter Delegate to the Annual Meeting in Dallas. President Holmes complimented the North Texas Chapter for the efficiency and cordial handling of affairs at Dallas. Committee chairmen were then announced by the president as: *program* — G. C. Bergtholdt; *meeting* — C. H. Dollmeyer; *research*—R. W. Winget.

Following a general discussion on the status and present effectiveness of the local heating and ventilating code, President Holmes introduced the speaker, James Shipman of the Oklahoma Natural Gas Co., who spoke on *Combustion.* An interesting discussion followed. Attendance 18. Attendance ratio 0.53.

• **NORTHERN OHIO** — January 9, 1950. A suitable topic for any time of the year was discussed at a meeting held in the Cleveland Engineering Society Bldg. at which Pres. R. L. Byers presided. *The Effect of Lake Erie on the Climate of Cleveland* was the subject of the talk given by C. G. Andrus, chief of the Cleveland Weather Bureau Station. Mr. Andrus stated that due to the seasonal time lag in changing the temperature of Lake Erie water the extreme hot and cold peaks of weather are tempered; the cold winds blowing across the Lake are warmed in the winter and hot summer winds are cooled. Due to differences in the

temperature between the Lake and surrounding land, people in Cleveland often enjoy a cooling Lake breeze in summer afternoons and evenings.

Mr. Andrus explained that much of the cloudiness of fall, winter and early spring is caused by the vapors of the relatively warm water of the Lake. In the summer, he stated, much cloudiness is reduced by the relatively low temperature of the Lake, thus giving Cleveland an abundance of sunshine in the summer. The moderating effect of the Lake on the south shore is very conducive to growing grapes, fruits and other agricultural products. Mr. Andrus explained that very slight shifts in wind direction may produce quite wide and sudden variations in weather in the Cleveland area. Mr. Andrus' talk was well received and was followed by an interesting discussion. Attendance 57. Attendance ratio 0.32.

• **OKLAHOMA** — January 20, 1950. H. S. Shafer, president of the Chapter, called the meeting to order in Beverly's Drive-In, Oklahoma City. Marion Levy, president of the Viking Air Conditioning Corp. of Cleveland, delivered an address on *Perimeter Heating*. A short discussion period followed before adjournment at 9:30 p.m. Attendance 51.

• **ONTARIO**—February 9, 1950. At a meeting held in the Royal York Hotel, J. H. Fox, vice president, took over for Pres. A. J. Strain who had injured his foot on his way to the meeting. Mr. Fox welcomed the guests, particularly those from other provinces. It was decided at this meeting that the secretary should write to the president of the North Texas Chapter thanking the Chapter for the hospitality and the many courtesies extended to the Canadian members during their stay in Dallas.

C. A. Hulse, Johns-Manville Co., Ltd., presented a 45 minute sound motion picture on the subject *Heat Losses and Insulation*, which was followed by a discussion period. Attendance 106. Attendance ratio 0.42.

• **OREGON**—January 5, 1950. J. P. McDermott, president of the Chapter, was on hand to open the January meeting and immediately called for reports from the various committee chairmen and the treasurer. Considerable discussion took place on the posibility of a Society meeting in Portland and a motion was made and approved to extend an invitation to the Society to hold the 1951 Semi-Annual Meeting in Portland. Following comments on the Society's new By-Laws, President McDermott turned the meeting over to R. C. Chewning who introduced "Bill" Hoss of Minneapolis-Honeywell Regulator Co., who gave an analysis on the status of residential heat pumps.

Mr. Hoss has been working on residential heat pumps for two years and prior to that his interest in the subject was stimulated by his experience as application engineer for the Minneapolis-Honeywell Co. on the Oregonian Building. He gave the most up-to-date, reliable information available on residential heat pumps in the Portland area and his talk brought about much discussion. The Chapter extended its appreciation to Mr. Hoss for his splendid presentation. Attendance 53.

• **PACIFIC NORTHWEST**—February 7, 1950. Prof. E. O. Eastwood, past president of the Society, performed his commentary duty and introduced Pres. Lester T. Avery, Cleveland, who spoke on *Good Air—Good Work* at the meeting held at the Engineers' Club. President Avery gave a most interesting presentation on air, which was once taken for granted and now is a subject of intensive study by scientists in many fields.

President Avery's talk gave the human comfort engineers something to think about, for example, the making of good air and comfort conditions by the proper utilization of the various tools at their disposal. He illustrated how the understanding and appreciation of good air and the knowledge of physiological reactions of man to air enables engineers to advance with the equipment and devices now available, and thereby provide the conditions recognized as desirable, and so extend the horizons a little farther in the direction of good air.

The interest aroused was displayed by the lengthy discussion which followed President Avery's talk which was not only interesting but educational. Attendance 61. Attendance ratio 0.74.

• **PHILADELPHIA** — February 9, 1950. Members and guests met at the Engineers' Club in Philadelphia for their monthly meeting. Cyril Tasker, director of research, ASHVE Research Laboratory, Cleveland, addressed the meeting on the *What and Why of ASHVE Research*. His talk was informative and well received by the membership. Attendance 58. Attendance ratio 0.23.

• **PITTSBURGH**—February 13, 1950. Pres. H. J. Kirkendall presided at the meeting held in the University Room at the Webster Hall Hotel, where C. H. Schneider reported as Chapter Delegate to the Dallas Meeting. He discussed the new Society By-Laws and announced that the Society's coming Semi-Annual Meeting would be held at Lake Muskoka, Ontario, and that the next Annual Meeting would be held in Philadelphia in January 1951.

President Kirkendall expressed his appreciation to the members of the history committee for the report on their findings. Following an announcement on future meetings, A. F. Metzger, program chairman, introduced Society members from out of town including Prof. E. R. Queer, State College, Pa.; P. B. Gordon, New York; John James, Chicago; L. N. Hunter, Johnstown, Pa.; Cyril Tasker and C. M. Humphreys, Cleveland.

The guest of the evening, E. C. Collins of the Alco Co. and superintendent of construction for the new building now being erected in Pittsburgh, spoke on *Engineering Aspects of the New Aluminum Co. Office Building*. He described the

construction pointing out the differences in the new method in comparison to the old method of construction. He stated that aluminum will be used wherever possible throughout the entire thirty story building, inside and outside.

B. R. Small gave a description of the radiant heating and cooling panels and explained the construction and installation of the panels. A movie showing the construction from the start of the building and as it will look when completed was then shown. The speaker announced that it is expected that the building will be completed in 1952 and the upper fifteen floors will be occupied by the Aluminum Co. of America. According to the Secretary's report, this was the best attended meeting of the Pittsburgh Chapter. Attendance 105.

• **ROCKY MOUNTAIN**—February 1, 1950. Silver Wing Restauant, Englewood, Colo., was the meeting place for the February meeting which was presided over by Pres. E. J. McEahern, who called on the various committee chairmen to give their respective reports. President McEahern, the Chapter Delegate to the Dallas Meeting, gave his impressions of the activities at the meeting and then discussed the matter of securing speakers for future meetings.

P. W. Young announced the forthcoming school on *Indoor Comfort* under the auspices of the *National Warm Air Heating and Air Conditioning Association*. G. A. Voorhees will be the principal speaker. Fred Janssen, a member of the Society's Nominating Committee, was then introduced.

J. H. McCabe, branch manager of the American Blower Co. and guest of the evening, addressed the meeting on *Fans and Their Application*. He demonstrated performance curves of four different types of fans, such as forward curved blades, radial blades, backward curved blades and axivane. He analyzed these curves, showing the advantages and disadvantages of each type, based on efficiency, noise level, overloading characteristics, relative sizes, etc.

Mr. McCabe went into considerable detail on methods of correcting sea level ratings for high altitude and cited many illustrations from installations he had checked during 25 years of fan engineering. A spirited discussion took place at the conclusion of Mr. McCabe's talk and one of the points debated was the best method of correcting the horsepower ratings of blowers for high altitudes. Attendance 58. Attendance ratio 0.38.

• **ST. LOUIS**—February 7, 1950. W. N. Mangold, district engineer of the General Electric Co. Lamp Department, delivered an interesting talk on *The Relationship Between Properly Designed Illuminating Systems and Heating and Ventilating and Air Conditioning Systems*. He supplied a wealth of technical data on the use, application, and operation of present day lighting methods and equipment covering sodium, fluorescent and filament type lamps, also special low temperature, as well as high temperature space lighting equipment. His talk further covered the application of germicidal lamps in direct room application, as well as in the application to air conditioning systems. Definitions of technical terms were given along with much technical data.

Mr. Mangold illustrated, by means of slides, examples of both good and poor lighting applications and pointed out that good lighting was a combination of both brightness or intensity and quality and that the trend in general lighting and particularly in commercial work was to high foot-candles or light intensity. He also pointed out that rapid strides are being made in improving quality and application of lighting to reduce eye and nervous strain and so improve the effectiveness and efficiency of those dependent upon artificial lighting.

Mr. Mangold's talk gave his audience a better understanding of what the architect and illuminating engineers are seeking to achieve in modern construction. At the conclusion of the talk, a prolonged question and answer period took place which terminated with a rising vote of thanks to the speaker.

B. L. Evans, chairman of the 1950 Chapters' Conference Committee, gave an enlivened and interesting report of the Chapter Delegates meetings in Dallas. It was announced that G. W. F. Myers was appointed a member of the Society's Charter and By-Laws Committee. It was the opinion of all present that St. Louis Chapter was ably represented at the Society's Annual Meeting in Dallas. Attendance 38.

• **SOUTH TEXAS**—February 17, 1950. Pres. R. J. Salinger opened the meeting at Bill Williams Restaurant and called upon A. F. Barnes, who reported that the requested change in the by-laws of the Engineers Council had been presented but that no action had been taken. Sidney Bromberg reported for the membership committee, followed by the introduction of H. Dan Weisser, who spoke on *The Effect of Lighting with Relation to Air Conditioning*. He stated that the air conditioning load may always be reduced by changing conventional lighting to fluorescent but pointed out that attention must be given to such matters as locating ballast outside of conditioned space. He touched on many other matters of lighting layout as affecting air conditioning load calculations. His talk was well received.

B. P. Fisher announced that any members needing the services of newly graduated engineers should get in touch with him or any other member of the placement committee.

The secretary was instructed to write to C. Rollins Gardner, general chairman of the Committee on Arrangements, thanking him and the North Texas Chapter for their outstanding work in conducting the 1950 Annual Meeting. Attendance 59. Attendance ratio 0.33.

• **SOUTHERN CALIFORNIA**—February 1, 1950. Pres. J. L. Blake and Vice Pres. L. J. Helms gave their

versions of the activities at the Dallas Meeting and their remarks were well received. Leo Hungerford introduced the President of ASHVE, Lester T. Avery, who delivered an address on *Good Air—Good Work* and his theme was stressing better air conditioning for the general atmosphere, comfort air conditioning and process air conditioning. President Avery discussed some valuable concepts of temperature, humidity and air motion in air conditioning and illustrated many of his points with slides. In his talk, President Avery brought out the fact that he felt members of the Society should use their knowledge and experience to raise the whole level of accomplishment in the industry. A discussion period followed President Avery's talk which was well received. Attendance 71.

• **SOUTHWEST TEXAS** — February 21, 1950. Vice Pres. Ira W. Wilke, in the absence of the president, presided at the meeting held in the Austin Hotel and reported on the activities in Dallas. L. T. Davis, president of the University of Texas Student Branch, introduced the speaker of the evening, John Watt, assistant professor of mechanical engineering of the University of Texas. Professor Watt gave a very worthwhile talk on the history of ice making and the development and operation of the extrusion process of ice manufacture as developed by the speaker. Questions were asked from the floor and were answered by Professor Watt by means of slides. Attendance 44. Attendance ratio 0.44.

• **WASHINGTON, D. C.**—February 8, 1950. The February meeting took the form of an informal social meeting and smoker and all business and technical discussion was dispensed with. It was held at the Engineer's Club in Washington with dinner preceding the entertainment. The secretary reported that the evening of fellowship was enjoyed by all judging from the many favorable comments. Attendance 53. Attendance ratio 0.48.

• **WISCONSIN** — January 16, 1950. The January meeting was held in the Engineers' Society Bldg. in Milwaukee and before introducing the speaker of the evening, Ernest Szekely, Second Vice President of ASHVE, spoke briefly on the proposed changes in the Society's By-Laws. After the business matters were taken care of, J. R. Vernon introduced the speaker, S. I. Rottmayer, engineer with Samuel R. Lewis and Assoc., Chicago, who spoke on *Water Conservation Devices Used in Refrigeration Systems.* Mr. Rottmayer explained that the cities bounding the Great Lakes are blessed with an abundance of water and that water conservation devices for refrigerating and air conditioning systems are used in these cities only where sewers or water mains are inadequate. In other areas these devices would be used where the cost of water is relatively high. The devices described by Mr. Rottmayer were gravity cooling towers, mechanical draft cooling towers and evaporative condensers. In these water conservation devices the amount of water used is only five to ten percent of the amount required without them, and there is no waste to the sewers.

Mr. Rottmayer further explained some of the operating and design characteristics of these three types of equipment, and his talk was illustrated by slides. At the conclusion of the formal part of the talk, Mr. Rottmayer answered questions presented to him by various members of the audience. Attendance 52. Attendance ratio 0.48.

## STUDENT BRANCHES

▲ **TEXAS A. & M.**—February 14, 1950. The meeting was called to order at the Mechanical Engineering Laboratory of the College by Pres. J. E. Schumann. W. E. Richard was appointed chairman of the program committee for the Spring semester. In compliance with the motion passed at the previous meeting, the newly elected officers were announced as follows: *President*—J. E. Schumann; *Vice President*—W. E. Richard; *Secretary*—A. G. Seelke; *Treasurer*—C. F. Cogan. Vice President Richard introduced H. R. Barden, director of fireman's training for Texas, who spoke on *Safety in Use of Liquefied Petroleum Gases.* Attendance 20. Attendance ratio 0.35.

▲ **UNIVERSITY OF TEXAS**—January 5, 1950. Pres. D. S. Belvin opened the January 5 meeting and it was decided to hold future meetings on the first and third Tuesdays of each month. Election of officers was held with the following results: *President*—L. T. Davis; *Vice President*—L. E. Scott; *Secretary*—A. G. Allen; *Treasurer*—F. T. Saade. Attendance 18. Attendance ratio 0.33.

## PERSONALS

Richard T. Demarest, a member of ASHVE, *ASME*, and *American Welding Society*, has been appointed market analyst for the Mor-Sun Furnace Division of Morrison Steel Products, Inc., Buffalo, N. Y. Mr. Demarest was formerly assistant to the field sales manager, of the Fitzgibbons Boiler Co,. New York, and has had a wide experience in all phases of sales promotion, marketing and research.

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The Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., has announced the following promotions: W. W. Martenis, manager of sales engineering, formerly chief application engineer; Fred Kaiser, field sales manager, formerly midwest regional manager. C. L. Peterson, formerly Pacific regional manager, San Francisco, has succeeded Mr. Kaiser, and R. C. Cushing, San Francisco, sales staff, has become branch manager.

K. L. Wilson has been named manager of the company's newly formed manufacturers' division. T. S. Carley, formerly Detroit branch manager, has succeeded Mr. Wilson at the office in Dallas. K. W. Schick, rejoining Minneapolis - Honeywell after a year as a distributor, is now sales manager, gas controls division.

# Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society or sent to the members in other approved manner as ordered by the Council. When the replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 113 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by April 25, 1950, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

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## OBITUARY

John J. Shanahan, owner of John J. Shanahan, contractor, Norfolk, Va., died unexpectedly on March 1 at his home, at the age of 68.

Born in Bridgeport, Conn., on August 26, 1881, he attended the public schools in that city. He furthered his education through an extension course at Columbia University and the International Correspondence Schools.

He moved to New York, where he resided for 10 years and supervised large construction projects. His first employment was in the plumbing and heating industry. In 1914, he was married in Brooklyn to the former Miss Alice Pearsall, who died a few years ago.

In 1919, he took up residence in Norfolk and a year later he entered business.

Mr. Shanahan was past president and member of the board of directors of the *Virginia State Association of Plumbing and Heating Contractors.* At one time he headed the association's apprenticeship committee. On three occasions, he served as president of the Norfolk Boy's Club and for 12 years was organization committee chairman of the Tidewater Council, Boy Scouts of America. He also served three terms as president of the Builders and Contractors Exchange.

He was a member of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS and served on the Board of Governors of the Virginia Chapter for three years, and was one of its most active members.

He also held membership in the *National Association of Master Plumbers,* the *Heating, Piping and Air Conditioning Contractors National Association* and affiliated State and local associations.

He is survived by two daughters, Miss Honora Dorothy Shanahan, of Norfolk and Mrs. Harrison M. Symmes, Jr., of Damascus, Syria; one sister, Mrs. Hannah Skelly, of Stratford, Conn.

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## Survey of Engineering Personnel

The *Engineers Joint Council*, 29 West 39th St., New York, N. Y., has announced the results of a survey of engineering personnel conducted for the National Military Establishment. Eighteen national engineering Societies cooperated by addressing questionnaires and 3 in. × 5 in. record cards, for approximately 108,500 members. Duplications were removed and follow-up postcards were mailed to 62,137 in September 1949.

A mailing company separated questionnaires and record cards for approximately 11,350 duplicate memberships, then in July 1949 mailed questionnaires to 97,117 engineers. The first mailing, in a window envelope, included an introductory letter, a *Request for Other Names* blank, a questionnaire, and a return post-paid envelope.

To date, 68,655 replies have been received and each reply has been recorded on the record card. Many questions were answered by letters. Some men had died, many were in poor health, retired, *too old*, many had replied to *American Men of Science*, hence did not fill out the questionnaire. Also, a few regular officers and a few civilian employees of the Department of Defense did not fill out the questionnaire. There was a small number of objectors, *Too many questionnaires, not interested, prefer not to fill out, present job permanent in war time*, etc.

To date, 59,000 questionnaires have been forwarded to the Bureau of Labor Statistics, Boston, Mass. That agency codes each item and writes a *Transcription Sheet* for each questionnaire, sends sheet and questionnaire to a Navy agency in Washington. That agency punches three 80 column IBM cards for each *Transcription Sheet*. The cards and questionnaires are going to the Manpower Branch, Human Resources Division, Office of Naval Research. Further analyses and tabulation is planned.

# JOURNAL SECTION

## OFFICERS OF LOCAL CHAPTERS AND STUDENT BRANCHES

(42 Chapters—10 Student Branches)

**• ATLANTA:** Organized 1937. Headquarters, Atlanta, Ga. Meets, Second Monday. PRESIDENT, W. M. Garrard, 810 Bona Allen Bldg., Atlanta 3. SECRETARY, E. K. Jamison, P. O. Box 1248, Atlanta, Ga.

**• BALTIMORE:** Organized 1949. Headquarters, Baltimore, Md. Meets, Third Wednesday. PRESIDENT, E. L. Crosby, 2315 St. Paul St., Baltimore 18. SECRETARY, W. P. Flanigan, 5508 Greenleaf Rd., Baltimore 10.

**• CENTRAL NEW YORK:** Organized 1944. Headquarters, Syracuse, N. Y. President, V. S. Day, 300 S. Geddes St., Syracuse 1. Secretary, J. H. Carpenter, 3515 Midland Ave., Syracuse 7.

**• CENTRAL OHIO:** Organized 1944. Headquarters, Columbus, Ohio. Meets, Third Monday. PRESIDENT, E. A. Norman, Jr., 1150 Chesapeake Ave., Columbus 12. SECRETARY, R. S. Curl, 590 Oak St., Columbus.

**• CINCINNATI:** Organized 1932. Headquarters, Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, K. B. Little, 832 Temple Bar Bldg., Cincinnati 2. SECRETARY, D. J. Wood, 659 E. Sixth St., Cincinnati.

**• CONNECTICUT:** Organized 1940. Headquarters, New Haven, Conn. Meets, Third Thursday. PRESIDENT, Winfield Roeder, 405 Temple St., New Haven. SECRETARY, T. L. Arnold, 26 Francis Ave., Hartford.

**• DELTA:** Organized 1939. Headquarters, New Orleans, La. Meets, Second Tuesday. PRESIDENT, R. B. Guest, 827-37 Dryades St., New Orleans 13. SECRETARY, Theodore Offner, 1000 S. Peters St., New Orleans.

**• GOLDEN GATE:** Organized 1937. Headquarters, San Francisco, Calif. Meets, First Thursday. PRESIDENT, Karl F. Baldwin, Jr., 419 Kentucky Ave., Berkeley 7. SECRETARY, Thomas J. Janes, University of California, Berkeley 4.

**• ILLINOIS:** Organized 1906. Headquarters, Chicago, Ill. Meets, Second Monday. PRESIDENT, J. S. Kearney, 1905 Greenleaf St., Evanston. SECRETARY, G. W. Bornquist, 629 W. Washington Blvd., Chicago 6.

**• INDIANA:** Organized 1943. Headquarters, Indianapolis, Ind. Meets, Fourth Friday. PRESIDENT, W. R. Fenstermaker, 937 Architects & Builders Bldg., Indianapolis 4. SECRETARY, F. C. Barton, 938 K of P Bldg., Indianapolis.

**• IOWA:** Organized 1940. Headquarters, Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, D. E. Wells, 304 Home Federal Bldg., Des Moines 9. SECRETARY, C. P. North, P.O. Box 833, Des Moines 4.

**• KANSAS CITY:** Organized 1917. Headquarters, Kansas City, Mo. Meets, First Monday. PRESIDENT, Henry Nottberg, Jr., 914 Campbell, Kansas City 6. SECRETARY, C. W. Schumacher, 1922 Grand Ave., Kansas City 9.

**• MANITOBA:** Organized 1935. Headquarters, Winnipeg, Man., Canada. Meets, Third Thursday. President, A. W. Moss, 268 Yale Ave., Winnipeg. Secretary, C. M. Fleming, 447 Main St., Winnipeg.

**• MASSACHUSETTS:** Organized 1912. Headquarters, Boston, Mass. Meets, Third Tuesday. PRESIDENT, W. H. Shipp, 124 Lewis Rd., Belmont 78. SECRETARY, W. A. Williams, 10 Sevinor Rd., Marblehead.

**• MEMPHIS:** Organized 1944. Headquarters, Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Wellford, Jr., 730 S. Third St., Memphis 2. SECRETARY, A. T. Sevil, 1521 Waverly Ave., Memphis 6.

**• MICHIGAN:** Organized 1916. Headquarters, Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, L. A. Burch, 5853 Hamilton Ave., Detroit 2. SECRETARY, J. H. Spurgeon, 23501 Hoover Rd., Van Dyke.

**• MINNESOTA:** Organized 1918. Headquarters, Minneapolis, Minn. Meets, First Monday. PRESIDENT, R. C. Jordan, University of Minnesota, Minneapolis 14. SECRETARY, E. F. Snyder, Jr., 4324 Zenith Ave., N., Minneapolis 12.

**• MONTREAL:** Organized 1936. Headquarters, Montreal, Que., Canada. Meets, Third Monday. President, S. W. Salter, 3410 Trenholme Ave., Montreal. Secretary, J. G. Chenevert, 1440 St. Catherine St., W., Montreal.

**• NEBRASKA:** Organized 1940. Headquarters, Omaha, Neb. Meets, Second Tuesday. PRESIDENT, C. A. Carter, 3019 Grebe St., Omaha 12. SECRETARY, K. E. Martin, 803 Patterson Bldg., Omaha 2.

**• NEW YORK:** Organized 1911. Headquarters, New York, N. Y. Meets, Third Monday. President, H. S. Johnson, 39 Cortlandt St., New York 7. Secretary, Carl H. Flink, Room 3000, 51 Madison Ave., New York 10.

**• NORTH CAROLINA:** Organized 1939. Headquarters, Durham, N. C. Meets, Quarterly. PRESIDENT, M. F. DuChateau, 205 S. Lyndon St., Greensboro. SECRETARY, G. B. Rottman, 401 S. Chapman St., Greensboro.

**• NORTH TEXAS:** Organized 1938. Headquarters, Dallas, Tex. Meets, Third Monday. PRESIDENT, Herman Blum, 2812 Fairmount, Dallas 4. SECRETARY, R. E. Allison, 601 First Ave., Dallas 10.

**• NORTHEASTERN OKLAHOMA:** Organized 1948. Headquarters, Tulsa, Okla. PRESIDENT, A. D. Holmes, 323 W. First St., Tulsa. SECRETARY, J. N. Watt, 528 E. Fifth St., Tulsa.

**• NORTHERN OHIO:** Organized 1916. Headquarters, Cleveland, Ohio. Meets, Second Monday. PRESIDENT, R. L. Byers, 1740 E. 12th St., Cleveland 14. SECRETARY, G. V. Parmelee, 94 Solon Rd., Chagrin Falls.

**• OKLAHOMA:** Organized 1935. Headquarters, Oklahoma City, Okla. Meets, Second Monday. President, H. S. Shafer, 400 Key Bldg., Oklahoma City 2. Secretary, R. E. Swan, 2 N. W. Sixth St., Oklahoma City.

**• ONTARIO:** Organized 1922. Headquarters, Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, A. J. Strain, 474 Bathurst St., Toronto. SECRETARY, H. R. Roth, 57 Bloor St., W., Toronto, Ont.

**• OREGON:** Organized 1939. Headquarters, Portland, Ore. Meets, Thursday after First Tuesday. President, J. P. McDermott, 308 Dekum Bldg., Portland 4. Secretary, K. H. Hanson, 6317 S.E. 40th St., Portland.

**• PACIFIC NORTHWEST:** Organized 1928. Headquarters, Seattle, Wash. Meets, Second Tuesday. PRESIDENT, J. D. Sparks, 7331 W. Green Lake Way, Seattle 3. SECRETARY, W. B. Pride, 3228 37th Pl., Seattle 44.

**• PHILADELPHIA:** Organized 1916. Headquarters, Philadelphia, Pa. Meets, Second Thursday. President, F. H. Buzzard, 213-15 S. Broad St., Philadelphia 7. Secretary, C. F. Dietz, 3449 W. Indiana Ave., Philadelphia 32.

**• PITTSBURGH:** Organized 1919. Headquarters, Pittsburgh, Pa. Meets, Second Monday. PRESIDENT, H. J. Kirkendall, 291 Catalpa Pl., Pittsburgh 16. SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St., Pittsburgh 22.

**• ROCKY MOUNTAIN:** Organized 1944. Headquarters, Denver, Colo. Meets, First Wednesday. PRESIDENT, E. J. McEahern, 1146 Market, Denver 4. SECRETARY, N. H. Brickham, 2715 S. Humboldt, Denver.

**• ST. LOUIS:** Organized 1918. Headquarters, St. Louis, Mo. Meets, First Tuesday. PRESIDENT, W. A. Russell, 7918 Kingsbury Blvd., Clayton 5. SECRETARY, H. C. Sharp, 4060 W. Pine Blvd., St. Louis 8.

**• SHREVEPORT:** Organized 1948. Headquarters, Shreveport, La. Meets, Third Thursday. PRESIDENT, B. E. Segall, Jr., 603 Cotton St., Shreveport. SECRETARY, R. M. Hood, 411 Louisiana Ave., Shreveport.

**• SOUTH TEXAS:** Organized 1938. Headquarters, Houston, Tex. Meets, Third Friday. PRESIDENT, R. J. Salinger, 4510 Dewberry Lane, Houston 4. SECRETARY, G. J. Collins, P.O. Box 2463, Houston.

**• SOUTHERN CALIFORNIA:** Organized 1930. Headquarters, Los Angeles, Calif. Meets, Third Wednesday. PRESIDENT, J. L. Blake, 1700 S. Bedford St., Los Angeles 35. SECRETARY, M. C. Greiner, 1559 Club View Dr., Los Angeles 24.

**• SOUTHWEST TEXAS:** Organized 1946. Headquarters, San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, L. S. Pawkett, 816 Insurance Bldg., San Antonio 5. SECRETARY, W. E. Long, Mechanical Engineering Dept., University of Texas, Austin.

**• UTAH:** Organized 1944. Headquarters, Salt Lake City, Utah. Meets, First Wednesday. President, C. E. Ferguson, 838 E. Garfield Ave., Salt Lake City. Secretary, A. R. Curtis, 2211 Highland Dr., Salt Lake City.

**• VIRGINIA:** Organized 1946. Headquarters, Norfolk, Va. Meets Third Wednesday. PRESIDENT, W. P. Robinson, 1442 Ocean View Ave., Norfolk 3. SECRETARY, D. E. Phillips, P.O. Box 674, Newport News.

**• WASHINGTON, D. C.:** Organized 1935. Headquarters, Washington, D. C. Meets, Second Wednesday. President, P. R. Achenbach, Connecticut & Van Ness St., Washington, D. C. Secretary, J. G. Muirheid, 2013 New Hampshire Ave., N. W., Washington 9.

**• WESTERN MICHIGAN:** Organized 1931. Headquarters, Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, J. A. Alexander, P. O. Box 132, Station C, Grand Rapids. SECRETARY, L. A. Calcaterra, 1136-42 Plainfield Ave. N.E., Grand Rapids.

**• WESTERN NEW YORK:** Organized 1919. Headquarters, Buffalo, N. Y. Meets, Second Monday. PRESIDENT, F. J. Weber, 443 Delaware Ave., Buffalo 2. SECRETARY, J. M. Quackenbush, 610 Linwood Ave., Buffalo.

**• WISCONSIN:** Organized 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. PRESIDENT, B. M. Kluge, 1817 So. 66th St., Milwaukee 14. SECRETARY, J. A. Lofte, 2505 N. 97th St., Wauwatosa, 13.

### Student Branches

**• COLLEGE OF CITY OF NEW YORK:** Organized 1949. Headquarters, New York, N. Y. PRESIDENT, Norman Moskowitz, 153 Clinton Ave., Brooklyn 5. SECRETARY, Seymour Oestreicher, 2009 Bryant Ave., New York 60.

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**• NORTH CAROLINA STATE COLLEGE:** Organized 1948. Headquarters, Raleigh, N. C. PRESIDENT, J. J. Andrews, 710 Harvey St., Raleigh. SECRETARY, E. A. Stroupe, Jr., 416 Halifax St., Raleigh.

**• OKLAHOMA A. & M. COLLEGE:** Organized 1950. Headquarters, Stillwater, Okla. PRESIDENT, R. E. Metzkier, 14-E Midi, Box 563, Veterans Village, Stillwater. SECRETARY, W. D. Jenkins, 801 W. Walnut, Enid.

**• OREGON STATE COLLEGE:** Organized 1949. Headquarters, Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, M. B. Larson, 2311 N. E. Hancock, Portland 12. SECRETARY, Helen P. Lankow, 1349 S. E. Birch St., Portland 14.

**• PURDUE UNIVERSITY:** Organized 1948. Headquarters, W. Lafayette, Ind. CHAIRMAN, D. M. Williams, c/o W. T. Miller, Mechanical Engineering Bldg., Purdue University, W. Lafayette. SECRETARY, J. D. Tuttle, 359 Northwestern Ave., W. Lafayette.

**• TEXAS A. & M. COLLEGE:** Organized 1946. Headquarters, College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, John E. Schumann, Texas A. & M. College, General Delivery, College Station, Tex. SECRETARY, A. G. Seelke, Jr., Box 4251, College Station.

**• UNIVERSITY OF DETROIT:** Organized 1949. Headquarters, Detroit, Mich. Meets First Tuesday. PRESIDENT, L. M. Blanchette, 2245 Holcomb, Detroit 14. SECRETARY, S. H. Kosinski, 4439-30th, Detroit 10.

**• UNIVERSITY OF KANSAS:** Organized 1949. Headquarters, Lawrence, Kans. PRESIDENT, J. L. Williams, 5278 Central, Kansas City, Mo. SECRETARY, R. C. Umholtz, 2732 Michigan St., Topeka, Kans.

**• UNIVERSITY OF TEXAS:** Organized 1949. Headquarters, Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, L. T. Davis, 4409 Avenue C., Austin. SECRETARY, A. G. Allen, 1537B, Brackenridge Apts., Austin.

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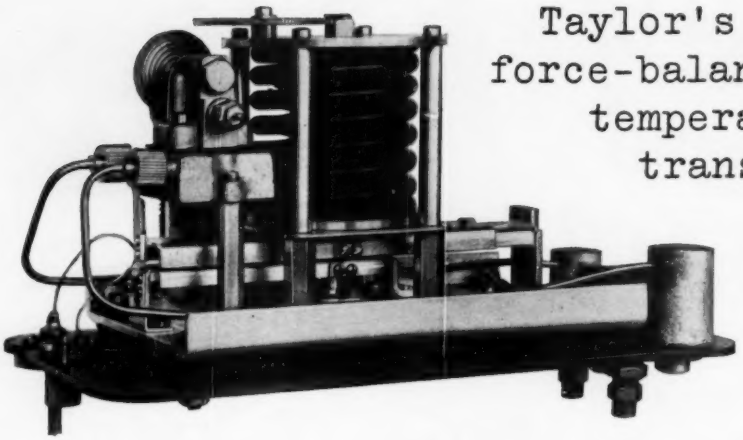

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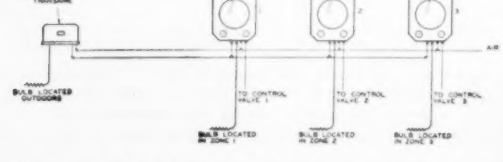
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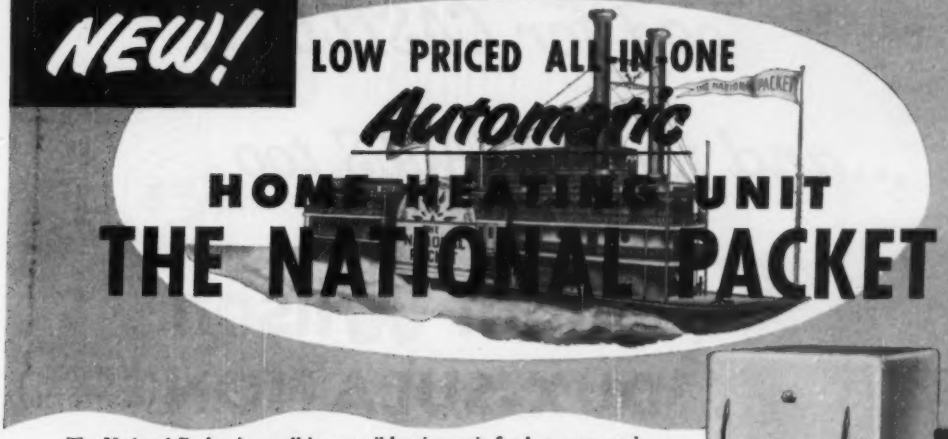
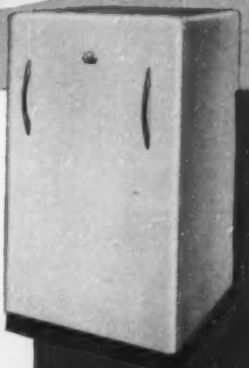
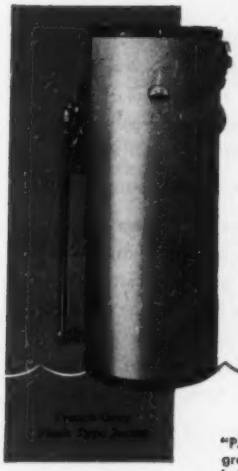


The National Packet is an all-in-one oil-heating unit for hot water and steam, engineered for the modern functional design of small homes, individual apartments, motels and stores. This integrated unit is so controlled that high efficiency and consequent economy are assured. The National Packet is complete—water pump and controls mounted—combustion chamber, jacket, insulation and burner in place—ready for immediate installation. Meets ASME Code construction requirements. Another valuable addition to National's distinguished family of heating products.



## EXCLUSIVE NATIONAL PACKET FEATURES

- High operating efficiency—horizontal flue travel across suspended active heating surface for maximum radiant heat absorption. Water backed heating surface extends to floor.
- Built-in expansion tank and air eliminators save space —save money.
- Tankless domestic hot water using special "jet-flow" principle provides abundant, quick hot water, year 'round.
- National "Raytrol" simplified control system insures adequate domestic hot water and even heat distribution.
- Unusual adaptability and compactness. Occupies approximately 4 square feet of floor space.



### Profitable for Wholesalers and Heating Contractors

—Low price makes it readily salable.

—Compact unit saves storage space.

—Low installation costs. Compact, all-in-one features make for quick, easy installation.

—Integrated assembly of high quality parts minimizes service call-backs.

See the NATIONAL PACKET for the first time at the OHI Show. Booth No. 418 Commercial Museum Philadelphia April 24 - 28, 1950

### THE PAGEANT OF PACKETS

"PACKET" recalls the story of those valiant boats that had such great impact on The American way of life during the latter half of the 19th Century. The Packet was the speediest, easiest-to-handle riverboat of its day. The Packet immediately brings to mind compactness, versatility and efficiency—thus "Packet" has been chosen as the name for this new and unique addition to National's famous line of heating products.

The National Radiator Company
221-B Central Avenue
Johnstown, Penna.
Send me more information on The National Packet.

Name_____

Street No._____

City Zone State

THE NATIONAL RADIATOR COMPANY

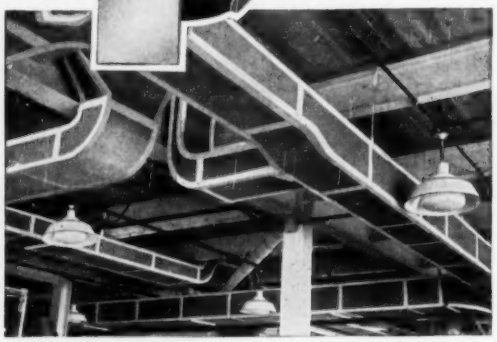
JOHNSTOWN, PENNSYLVANIA

# Good for CASTLES...

# ...and for COTTAGES, too

## Grant Wilson DUX-SULATION (ASBESTOS-PROTECTED)

**...keeps cool air *cool* or warm air *warm* between source and outlet—the "deluxe" specification that delivers MORE COMFORT *as well as* MORE ECONOMY!**



Dux-Sulation guarantees less temperature loss between furnace and register or air conditioner and grille. It helps equalize long and short runs, eliminates those "hard-to-heat" (or to cool) areas, and hushes mechanical noises to a new standard of silence.

Whether for heating or cooling systems, Dux-Sulation is the "deluxe" specification that, at the same time, actually reduces operating costs—that pays for itself over and over in fuel or power savings. Equally practical for low cost housing projects, swank hotels or giant Industrials, Dux-Sulation makes ANY duct installation *better!* May we send you complete facts?

## QUICK FACTS

Grant Wilson Asbestos-Protected Dux-Sulation is a Thermal/Acoustical insulation engineered specifically for duct application. With a K factor of .27 BTU, its insulation efficiency exceeds 75%; sound absorption is approximately 61%. Rot-proof, mildew-proof and insect-proof, Dux-Sulation can be applied to either the inside or outside of round, rectangular or irregular ducts—won't chip, crack or buckle and is flexible for easy bending—½" or 1" thickness in 36" rolls about 33 feet in length. Special tape and glue (included) make installation quick and simple. Write Grant Wilson, Inc., 141 W. Jackson Blvd., Chicago 4, Ill.

SEND FOR THIS *FREE* SAMPLE

**Grant Wilson inc.**

*ASBESTOS and INSULATING MATERIALS*

# Clean air tailored to building needs

## 3 types of AAF filters serve Oklahoma Natural Gas Building

*Coston & Frankfurt,*
**ARCHITECTS & ENGINEERS**
*Tom Dolan Heating Co., Inc.,*
**AIR CONDITIONING CONTRACTOR**

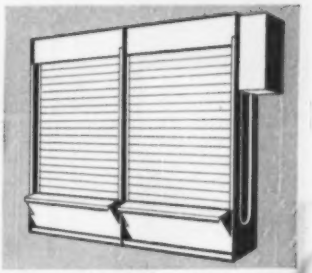
THERE is no one stock solution for every air filtering problem. That's why three different type AAF filters—Electro-Matic, Multi-Duty and Airmat PL-24 are incorporated in the air conditioning system of the new Oklahoma Natural Gas Building, Oklahoma City, Okla.

It is significant, though, that all units are products of American Air Filter. The reason—AAF is the only company offering a complete line of filters. That means both unbiased recommendations and a single responsible source for the overall air cleaning job.

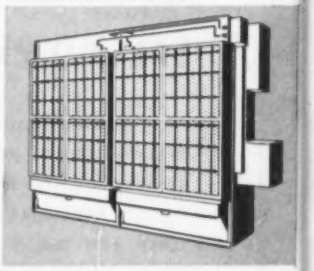
Filtered air is a sound investment for every business. And it's a better investment when you can recommend to your customers the right filter for every job. And with it goes the assurance that, regardless of choice, the units selected are of proved design and performance. For information on this complete filter line call your local AAF representative or write—

**AMERICAN AIR FILTER COMPANY, INC.**
**373 Central Avenue, Louisville 8, Ky.**
*In Canada: Darling Bros., Ltd., Montreal, P. Q.*

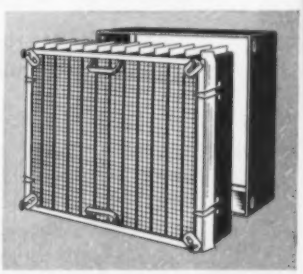
**AAF offers the only complete line of AIR FILTERS and ELECTRONIC PRECIPITATORS**



MULTI-DUTY automatic viscous filters provide a constant, unvarying supply of air at a uniform resistance and with minimum maintenance for the Oklahoma Natural Gas Building.



ELECTRO-MATIC, the only automatic electronic precipitator in which the self-cleaning feature simplifies maintenance and minimizes the human element as a factor of satisfactory performance.



AIRMAT Type PL-24, the most widely used dry type air filter for air conditioning and industrial ventilation. The inexpensive, disposable Airmat paper assures simple and convenient maintenance.

**Remember—**
**Only AAF offers "SELECTIVE AIR FILTRATION" ...the right filter for every job**

**AAF**
**AIR FILTERS**
**AND ELECTRONIC PRECIPITATORS**

SAL-MO PRODUCTS
The accumulated experience of more than 63 years engaged in developing and manufacturing Quality Asbestos Products is yours when you use Sal-Mo Asbestos Papers, Millboards, Tapes, Pipe Coverings and many others for domestic and industrial insulation.
Be sure to get the best . . . specify the Sal-Mo Trade Mark.
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Asbestos
UTILITY SERVICE ECONOMY
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# Try and name one we *don't* have!

Gone are those harried times when it was necessary to round up your gas heating equipment from many sources. Today, there's a man nearby who practically dares you to name a single unit he *cannot* supply.

You'll get quick quotations from the Bryant distributor on equipment for residential, commercial and industrial applications. He has boilers and unit heaters, warm-air furnaces, space heaters and conversion burners, and a new all-weather conditioner in the greatest line of gas heating equipment under a single nameplate.

You'll get better deliveries from him because of Bryant's enlarged production facilities, find willing assistance on engineering problems. And your customers nod their approval when you recommend his famous brand.

Helpful fellow, this Bryant distributor. Let him figure equipment for your new projects and *see for yourself!*

*Let the pup be furnace man ...and water boy, too!*

**bryant**

**AUTOMATIC HEATING**

The most complete line of gas heating equipment in the nation

Bryant Heater, Dept. 152,
17825 St. Clair, Cleveland, Ohio

( ) Send me the new booklet that tells the Bryant story. ( ) Have your distributor call on me.

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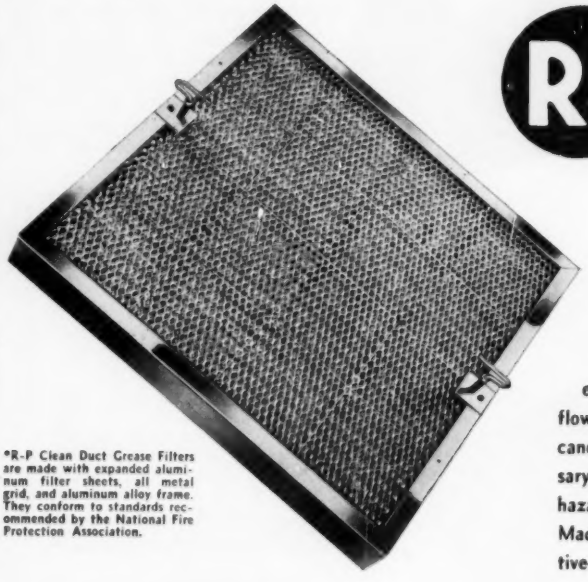
Company_____

Address_____

City_____ State_____

# "Two Over Well!"

Wherever you hear the familiar order "two over, well" . . . in the kitchens of eating places from coast to coast . . . there you will find a made-to-order spot for the R-P Alūmaloy Grease Filter installations. R-P Grease Filters pick up and hold 98% of all greasy vapors, dust, dirt, lint and foreign matter to keep ducts clear . . . TO REDUCE FIRE HAZARDS!



*R-P Clean Duct Grease Filters are made with expanded aluminum filter sheets, all metal grid, and aluminum alloy frame. They conform to standards recommended by the National Fire Protection Association.

## RP ALŪMALOY "Clean Duct" GREASE FILTER

Now you can be an expert on R-P Grease Filter installations! Simply write for our new booklet "How to plan and install Grease Filter Duct Systems". It tells all! R-P Clean Duct Grease Filters have high efficiency, extra holding capacity and low resistance to air flow. They can be installed in any type range canopy, and can be easily cleaned as often as necessary to maintain sanitation and guard against fire hazards. For details write, Research Products Corp., Madison 10, Wis., Dept. H. Canadian Representative—Delhi Industries, Delhi, Ontario.

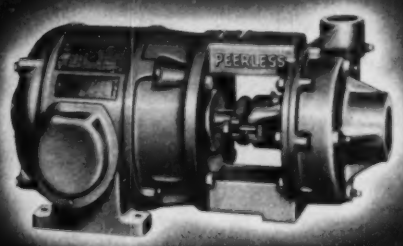
**RP . . . PRODUCTS OF RESEARCH**

WASHABLE AND REPLACEMENT AIR FILTERS • GREASE FILTERS • EVAPORATIVE COOLER MATERIALS

# DURABLE • ECONOMICAL • GENERAL UTILITY
## PUMPS FOR ALL ORDINARY LIQUID PUMPING SERVICES

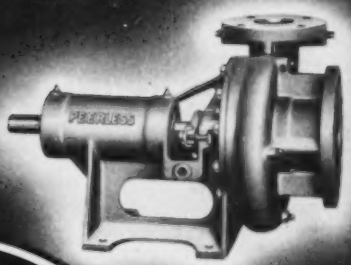
# THE PEERLESS *Fluidyne* LINE

**CLOSE-COUPLED TYPE**
***Integral H. P.***




Type PE MOTOR SIZE: 1-40 H.P.
CAPACITY: Up to 5500 gpm
HEADS: Up to 270 Feet

**BELTED OR DIRECT-CONNECTED TYPE *Integral H. P.***




Type PB MOTOR SIZE: 1-40 H.P.
CAPACITY: Up to 5500 gpm
HEADS: Up to 270 Feet

# PEERLESS PUMPS

**COMPLETE RANGE OF SIZES FROM ¼ TO 40 H.P.**

**CAPACITIES: UP TO 5500 G.P.M. • HEADS: UP TO 270 FEET**

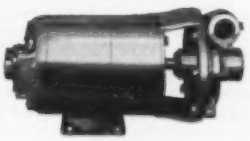
Want compactness? Want efficiency? Want durability? Want economy? You can have them all by using pumps in the versatile and complete line of Peerless Fluidyne general-purpose pumps. Versatile, because they can be applied to a host of diversified services calling for transfering of liquids such as water for air conditioning or cooling and refrigeration systems, mild alkaline solutions, booster service, process uses and many others. Complete, because they offer widest range of sizes and models. The Type PE Fluidyne pump, a close-coupled bracket-type pump is electric drive, available from ¼ to 40 h.p. It is direct-connected to standard NEMA electric motors. The Type PB offers the same wide h.p. range but differs from the PE in that it is built to receive standard V or flat belt pulleys for engine drive, or it can be mounted on a common base with an electric motor and driven by a flexible coupling.

Both Type PE and Type PB Fluidyne pumps are single stage, end suction, centrifugal design. Simplicity and quality and ruggedness are inherent in their design. All parts are easily accessible. Close attention to hydraulic characteristics has resulted in pumping units of high efficiency. Disassembly and assembly for inspection or maintenance is rapid.

Fluidyne pumps operate with unimpaired efficiency in any position—vertical, horizontal or intermediate angle. All parts of exacting Peerless manufacture found only in highest quality pumps. Evidence of their high quality is found in features such as high strength cast bronze streamflow impellers, replaceable bronze wear rings on pump case, oversize packing, drain pocket, ball bearings (PB unit), precision alloy steel shafts.

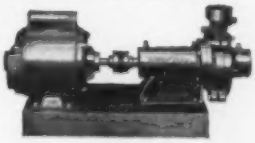
You can probably visualize a score of uses for these dependable, economical pumps. Write today for bulletins describing and illustrating Peerless Fluidyne pumps in the size and type you require.

**FRACTIONAL HORSEPOWER CLOSE-COUPLED TYPE PE**



¼ to 1 h.p. • 3450 rpm • 60 cycle
Capacity: To 50 gpm • Heads: To 90 Ft.

**DIRECT OR BELTED TYPE PB FRACTIONAL HP COMMON BASE**



¼ to 1 h.p. • 3450 rpm • 60 cycle
Capacity: To 50 gpm • Heads: To 90 Ft.

PEERLESS PUMPS fmc

**PEERLESS PUMP DIVISION**
**FOOD MACHINERY AND CHEMICAL CORPORATION**

Factories: Los Angeles, California, and Indianapolis, Indiana
Offices: New York, Atlanta, Fresno, Los Angeles, Chicago, St. Louis, Phoenix; Dallas, Plainview and Lubbock, Texas.

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● *Fedders Wall Radiation* provides new lower costs...easier and greater space-saving installations...lighter weight... easier handling...easier stocking.

TYPE EM ENCLOSURE
fabricated from expanded metal.

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having flat top with die-cut grille.

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having sloping top with die-formed louvered grille.

Increased efficiency of transferring heat is assured by the pattern stamped in the fins which creates a turbulent scrubbing action of airflow against fins. This die-formed pattern also produces greater fin strength.

Three styles of enclosures are available as illustrated.

*Fedders Wall Radiation* for steam and hot water lines is available in lengths from 2 to 12 feet in 6 inch increments. 38 and 50 fins per foot on 1¼ inch tube and 24 fins per foot on 2 inch tubes. Write for catalog WR-C1 TODAY.

**FEDDERS-QUIGAN CORPORATION**
BUFFALO 7, N. Y.

Quigan

# Precision Built . . . for Star Performance

**Write for these Emerson-Electric Motor Data Bulletins**

Appliance and equipment manufacturers, with applications for motors of 1/20 to 5 h.p., can profitably use these authoritative reference guides. Specifications, construction details and performance data are included for the following types:

- ☐ No. 337-A Capacitor-Start Motors
- ☐ No. 337-B Split-Phase Motors
- ☐ No. 337-C Integral Motors
- ☐ No. 337-D Fan-Duty Motors
- ☐ No. 337-E Oil-Burner Motors
- ☐ No. 337-F Jet Pump Motors
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You cannot compare the relative differences of the stars with the naked eye. So, too, with competitive products. Externally they may appear similar, yet one far outsells the other because of efficient, long-term performance. The motor you select, can give or deprive your equipment of an important sales advantage.

Knowing that the reputation of its motors is mirrored in the products they power, Emerson-Electric continues its 60-year policy of exhaustive research, scientific design engineering and precision production. Result, scores of America's best known products are Emerson-Electric Motor equipped.

Get the facts. If you have motor requirements in the 1/20 to 5 h.p. range, Emerson-Electric Motors deserve your investigation. Your inquiry is invited.

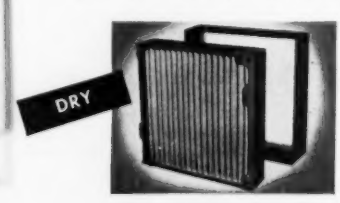
**THE EMERSON ELECTRIC MFG. CO.**
ST. LOUIS 21, MO.

**EMERSON ELECTRIC**
MOTORS • FANS — APPLIANCES

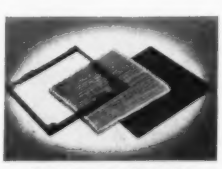
# STAYNEW PANEL FILTERS AVAILABLE IN THESE MAJOR TYPES...

## USERS ENDORSE BOTH FOR HEAVY DUTY VENTILATION SERVICE

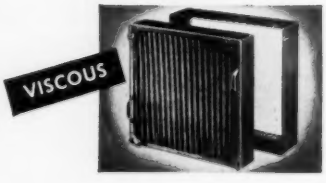
You can select a Staynew Filter—backed by 25 years of exclusive filter engineering experience—in either a DRY or a VISCOUS type. Both are heavily built, expertly designed units fulfilling the most exacting requirements of their respective applications. They provide outstanding performance in commercial and industrial installations. Full range of standard sizes in both types.



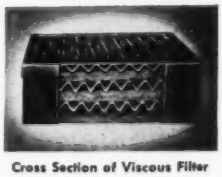

Filtering media to suit every requirement . . . easily cleaned . . . quick, inexpensive replacement of medium when required . . . greater filtering area . . . highly flame-resistant.



Dry Filter Cell Assembly




Large dust-holding capacity . . . medium arranged to provide "stage" filtration . . . unusually high dust removal efficiency . . . low resistance to air flow . . . unsurpassed cleaning ease.



Cross Section of Viscous Filter

*COMPLETE DETAILS ON REQUEST*

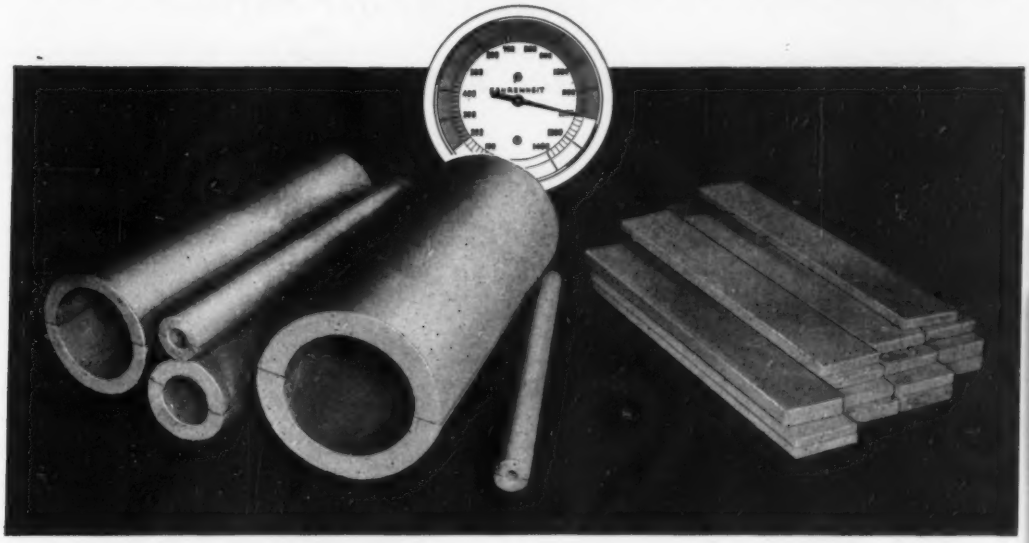
# DOLLINGER CORPORATION

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

9 CENTRE PK., ROCHESTER 3, N. Y.

Representatives In Principal Cities

# ONE MATERIAL INSULATES A 200°F.-1200°F. TEMPERATURE RANGE



**KAYLO HEAT INSULATING BLOCK** can be easily sawed, cut and scored with standard tools. Cement, canvas or other outer finishes can be applied with minimum effort. Finished jobs have a neat, clean appearance.

**KAYLO PIPE INSULATION** is produced in Simplified Dimensional Standards of thicknesses and diameters for snug nesting, when necessary. Available in thicknesses from 1 to 3 inches in 36-in. sections for pipe sizes from ½ inch to 12 inches.

Every engineer concerned with insulation problems should know about Kaylo Heat Insulating Block and Pipe Insulation. No other insulation provides such a combination of advantages.

Available in block or pipe covering form, this material is remarkably efficient throughout a wide 200°-1200°F. temperature range. It is strong and resistant to effects of moisture for long service. It is lightweight, easy to handle and apply.

Many types of industries have found this material ideal for their insulating needs. Get the facts now about Kaylo Heat Insulating Block and Kaylo Pipe Insulation.

# KAYLO®

## HEAT INSULATING BLOCK and PIPE COVERING

**OWENS-ILLINOIS GLASS COMPANY**
**Kaylo Division Toledo 1, Ohio**

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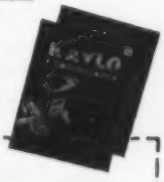
| | St. Louis | Toledo | Washington | |

**MAIL COUPON FOR KAYLO INSULATION SAMPLES AND LITERATURE**




**Owens-Illinois Glass Company**
**— Kaylo Division Dept. N-93, Toledo 1, Ohio**

Gentlemen: Please send me Kaylo heat insulation samples and descriptive literature.

NAME.....

FIRM.....

ADDRESS.....

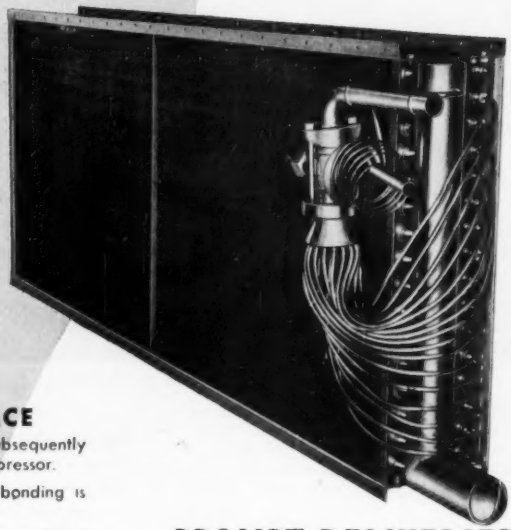
CITY..... STATE.....

*We can't* *make* ***all*** *the*

*Heat Transfer Surface*

*So we make the* ***Best*** *of it*

# ONLY KENNARD *Engineered* COILS



*Give You so Much...*

## CLEANER INSIDE SURFACE

Hydraulic stretching loosens scale and oxides subsequently blown OUT of coil reduces danger of scoring compressor.

SAFER COIL—Having withstood 3000 psi for bonding is safe-guarded against leaks.

UNIFORM EVEN STRESS—in ALL fins—good mechanical and thermal bond.

## NITROGEN ATMOSPHERE BRAZING

All header and distributor tube joints to the coil are phos-copper brazed in an inert Nitrogen Atmosphere to eliminate abrasive scale.

## NO-RUST FRAMES

Frames up to 72" are ALUMINUM. Larger sizes framed in steel, hot-dipped galvanized AFTER FABRICATION.

## ONE-PIECE FINS *(ALL LENGTHS)*

Solid plate type fin for ALL coils. Reduces air resistance. Requires less fan power. Minimizes fuzz and lint fouling.

*Underwriters Laboratories Approval**

*Does not apply to water and steam coils — not required

## *PROMPT DELIVERIES*

We are equipped to fabricate ANY type of Heating or Cooling Coils (any refrigerant) on prompt delivery schedules. Your inquiries are invited.

Write for Bulletins—

No. 47A—FINNED COILS

No. 486—AIR CONDITIONING BLOWER UNITS

No. 491—EVAPORATIVE CONDENSERS

No. 494—COOLING TOWERS

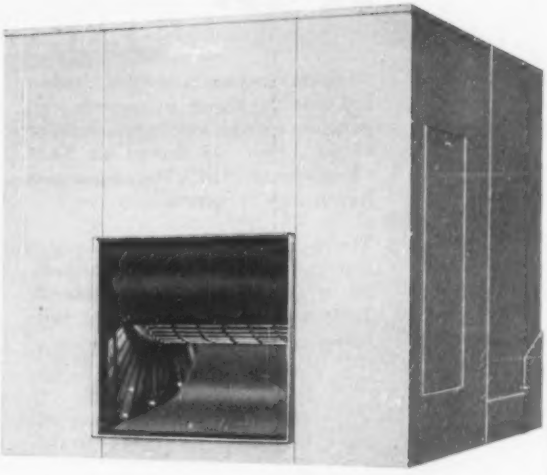
*"Refinement of Detail Marks the Difference Between Ordinary and Excellent"*

# KENNARD CORPORATION

1817 S. HANLEY RD., ST. LOUIS 17, MO.

# Comfort 4-WAY Air-Washer

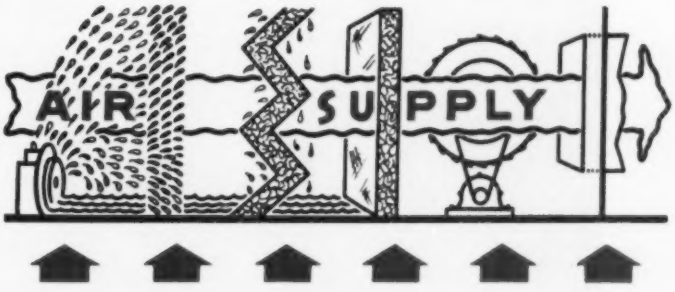
*a Better Product doing a Better Cooling Job*



The revolutionary Spray-Wheel Air-Washer was designed by Comfort to answer a real need in the evaporative cooler field. Comfort filled this industry-wide gap with these exclusive Air-Washer features: ★ No clogging filters ★ More pad area ★ Full-rated capacity ★ Odors eliminated ★ Trouble-free service ★ Longer life ★ Less CFM cost.

THE Comfort Air Washer . . . THE COOLING UNIT THAT DEFIES MAINTENANCE

Diagramatically here's the way the Comfort Air Washer works—




**INCOMING AIR** pre-washed of dust and dirt. Filter pads remain unclogged, cooling efficiency stays high and uniform.

**COMFORT'S SPRAY WHEEL** provides a continuous sheet of mist and heavy water over pad surfaces. NO PUMPS—NO SPRAY NOZZLES . . . trouble-free service.

**ONE-THIRD MORE PAD AREA** (stair-stepped) permits lower velocities, lower resistance, and higher efficiency.

**FIBERGLAS*** pads throughout—all vegetable and fungi ODORS ELIMINATED.

*Reg.

**SPECIAL BAFFLE FILTER** wrings excess moisture from the air stream . . . HUMIDITY REDUCED to absolute minimum.

**OVERSIZE BLOWER** and properly sized motor guarantee full- and TRUE - rated air supply . . . constructed for long life and heavy duty. NOISE AND VIBRATIONS reduced to negligible factor.

**NO NOISY** drafts . . . fixtures required, planned duct system distributes air supply in a gentle breeze . . . minimizes back pressure.

For further information write to . . .

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# Where temperature control is a must

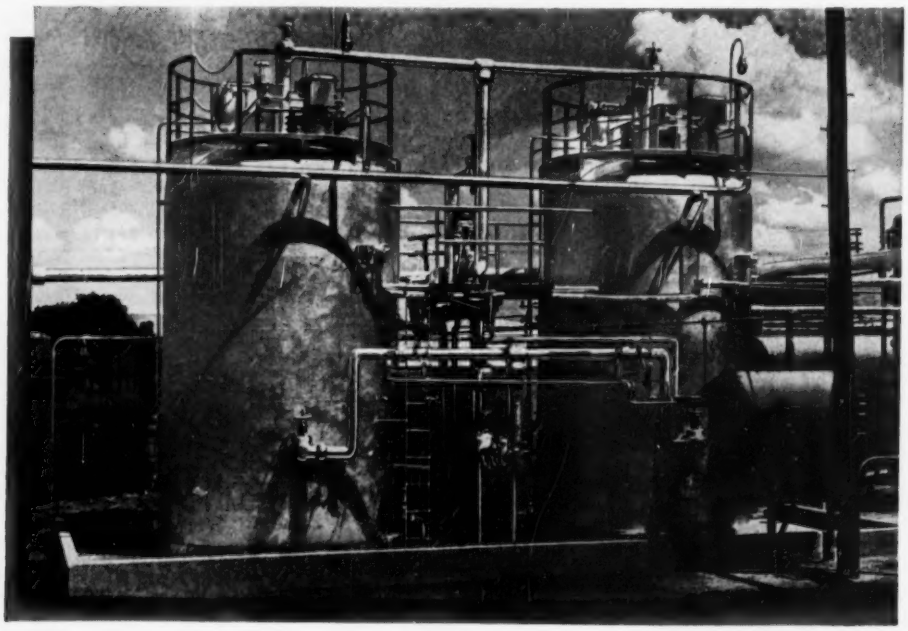
## K&M "FEATHERWEIGHT"® 85% MAGNESIA INSULATION

When your problem is complex . . . when you need the answer to accurate temperature control and high insulation value . . . you can depend on K&M "Featherweight" 85% Magnesia to take its full share of responsibility.

This dependable heat insulation assures high non-conductive efficiency that lasts. Its advantages come from the scientific K&M method of compounding clean asbestos fiber with basic carbonate of magnesia, in correct proportions—with proper distribution. The result is lightweight pipe and block insulation whose structural strength contributes to application and maintenance savings.

"Featherweight" 85% Magnesia, available in all standard dimensions, is one of the many types of insulation produced by K&M. Investigate them by obtaining full data and expert information from your nearest K&M Distributor.

***Owner:*** Midland Cooperative Wholesale Refining Co., Cushing, Oklahoma.
***Equipment:*** Desalters and Piping. ***Contractor:*** Armstrong Cork Co.
***Insulation:*** K&M "Featherweight" 85% Magnesia—Weatherproofed.



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# in handy 5-ounce packets

Now you can get this versatile, fast-acting low-temperature silver brazing alloy in convenient, sturdy 6½" square packets. Just the thing for — small shops — plumbers — refrigeration, electrical and other service men — maintenance and repair crews, etc. Also for all shops that make ferrous and non-ferrous metal products for silver alloy brazing trial work, tool repairs, etc. Each package contains a 5-ounce coil of 1/16" EASY-FLO 45 wire (approx. 330 lineal inches) — also torch brazing instructions and a "Quick Facts" folder giving full details about EASY-FLO 45.

**WRITE TODAY FOR OUR LIST OF DEALERS**

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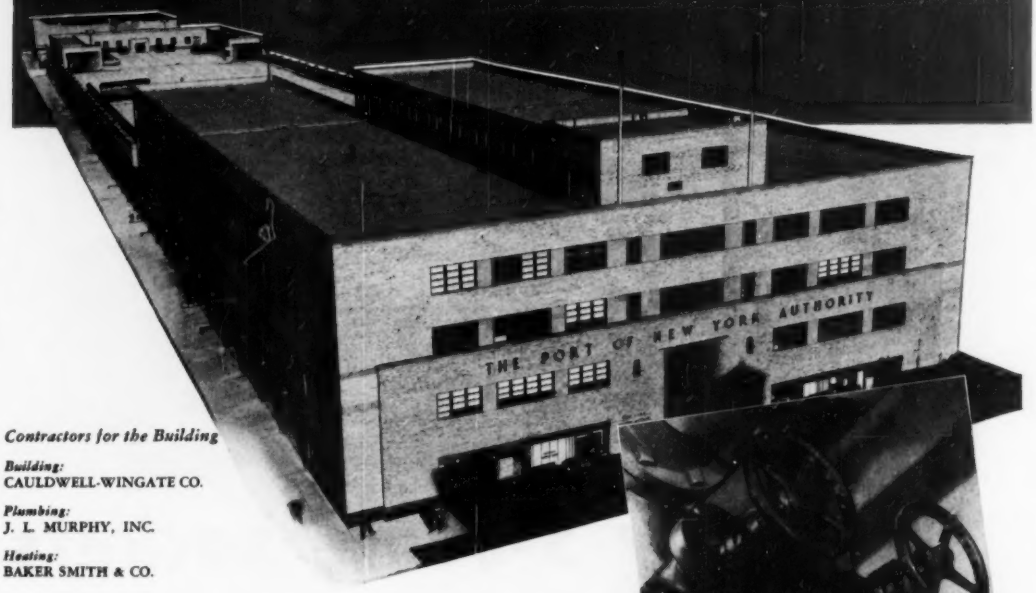
# JENKINS VALVES

## for lowest maintenance cost

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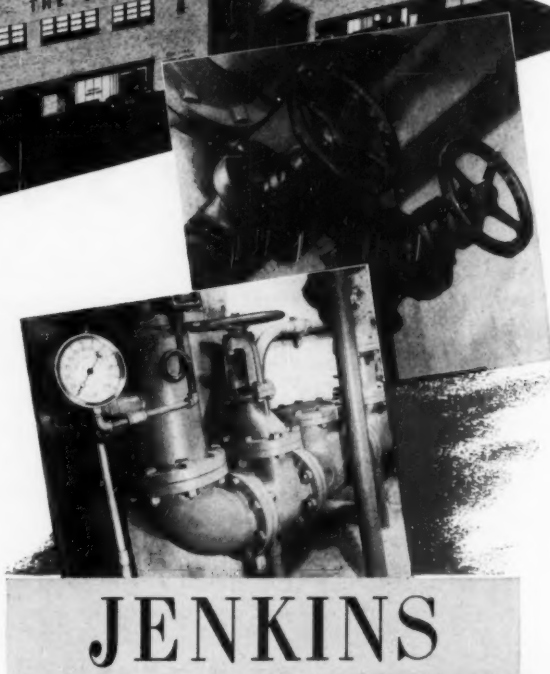

A CONSOLIDATING TERMINAL for interchange of mixed merchandise freight between over-the-road carriers and local city trucks, the New York Union Motor Truck Terminal was established to reduce shipping costs, and to relieve truck traffic congestions.

All equipment used in the terminal, whether for freight handling or building operation, was selected on the basis of *lowest possible maintenance cost.* That is why Jenkins Valves (over 2800) are installed in water, steam, fire, and other vital pipe lines.

Jenkins builds *extra* endurance into valves —proved time and again by low upkeep cost records in every type of service. Yet, *you pay no more* for Jenkins Valves, despite this extra value. Let the Jenkins Diamond be your guide to valve economy . . . for new installations, for all replacements. *Sold through leading Industrial Distributors everywhere.*

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JENKINS

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VALVES SINCE 1864

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# EQUIPMENT DEVELOPMENTS...

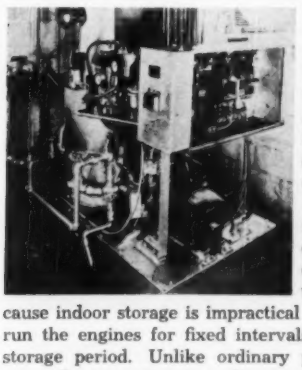
*For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1950 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk equipment and manufacturer not listed.*

**HPAC 4313—NEW REFRIGERANT**—"Carrene-7" is a new refrigerant which has been developed after six years of investigation carried out under the direction of Dr. William A. Pennington, chief chemist and metallurgist, Carrier Corp., Syracuse, N.Y.

It is said to possess all of the desirable properties required for a safety refrigerant and also to permit a reciprocating compressor charged with the new gas to produce a substantially greater refrigerating effect. It is an azeotropic mixture, always boiling at the same constant temperature corresponding to a particular pressure. Chemically it is composed of "Freon-12" and unsymmetrical difluoroethane ("Genetron-100").

The refrigerant is said to be an ideal solution to the 50 cycle problem as it gives almost the same capacity with a 50 cycle current as "Freon-12" does with a 60 cycle current. It is also said to be chemically stable, noninflammable, physiologically safe, and noncorrosive to common materials of construction. The cycle efficiency and other thermodynamic properties are similar to "Freon-12".

**HPAC 4314—HEATS WATER IN BUSES**—A new method of preventing the water in big passenger bus engines from freezing while stored outdoors overnight in cold weather has been developed by Tropic Aire, Inc., and Vapor Heating Corp., 80 E. Jackson Blvd., Chicago 4.



The present practice of bus line operators and transit companies that store vehicles outside because indoor storage is impractical or too expensive is to run the engines for fixed intervals during the night or storage period. Unlike ordinary passenger cars, buses generally use water in cooling systems in winter.

In the new method, the water in the cooling system is heated from a source independent of the vehicle. The system is connected to a hot water heater which derives its heat from a steam generator.

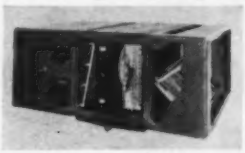
It is said that one generator, using 1 to 2 gph of fuel oil, can make 500 lb of steam and keep 20 buses warm in winter weather. After three hoses are attached to special fittings on the motor, automatic controls do the rest and a bell signal warns the caretaker if something requires adjustment.

Comparing costs, it is estimated that a bus motor running at idling speed consumes 5 to 8 gph of fuel and that 20 buses would use 100 or more gph.

The steam generator, using 1 to 2 gph of cheaper fuel and heating 20 buses, thus provides large fuel savings in addition to reducing engine wear and minimizing caretaker costs, says the company.

The 20 bus unit (shown here), one of which is used by Greyhound Corp., Chicago, is one of three models. The company also makes a 5 and 10 bus unit.

**HPAC 4315—AIR HANDLING UNITS**—A new line of air handling units, designated types AH and AV, intended primarily for remote installation in central plant type air conditioning systems is available from Sturtevant Div., Westinghouse Electric Corp. Hyde Park, Boston 36. These units are also designed for commercial and industrial heating and ventilating. Sizes range from 1650 to 14,060 cfm at 500 fpm coil face velocity when direct expansion coils are used and up to 18,000 cfm when water coils are used. Standard and double tube steam heating coils are also available. All coils utilize continuous plate fin construction.



[*Continued on page 166*]

**FOR YOUR CONVENIENCE** [4-50]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

*(Circle each HPAC number in which you are interested)*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 4313 | 4314 | 4315 | 4316 | 4317 | 4318 | 4319 | 4320 | 4321 | 4322 |
| 4323 | 4324 | 4325 | 4326 | 4327 | 4328 | 4329 | 4330 | 4331 | 4332 |
| 4333 | 4334 | 4335 | 4336 | 4337 | 4338 | 4339 | 4340 | 4341 | 4342 |
| 4343 | 4344 | | | | | | | | |
| 7602 | | 7604 | 7605 | 7606 | 7607 | 7608 | 7609 | 7610 | 7611 |
| 7612 | 7613 | 7614 | 7615 | 7616 | 7617 | 7618 | 7619 | 7620 | 7621 |
| | 7623 | 7624 | 7625 | 7626 | 7627 | 7628 | 7629 | 7630 | 7631 |
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# 15 STORIES of solid comfort!

## where steel pipe was first choice for modern radiant heating

Lucky are the modern "cliff dwellers" who reside at 91st Street and Madison Avenue, New York. For they are among the first fortunate tenants in America to get the advantages of radiant heating in a multiple dwelling unit.

With the outstanding performance of radiant systems in thousands of homes, in hospitals, schools and churches, it was inevitable that the clean, uniform comfort conditions produced by radiant heating would become a prominent feature in modern multiple dwelling construction. And, for the successful performance of a radiant system, steel pipe is the first choice as it always has been for conventional steam and hot water systems.

Steel pipe is, first of all, completely practical and adaptable. It can be formed readily, welded soundly and easily, and its expansion and contraction in concrete or plaster for all practical purposes may be considered the same. Moreover, it is durable . . . a fact proved beyond the shadow of a doubt in more than 60 years of use in steam and hot water heating systems. Economy is its important and considerable advantage.

For apartment dwellings or any other radiant heating purpose, steel pipe is first choice!

*City Investing Company, builder of this structure utilized steel pipe coils in the ceilings, with some supplemental wall piping and a few floor coils. Photo shows ceiling coils viewed from floor above.*

**COMMITTEE ON STEEL PIPE RESEARCH**

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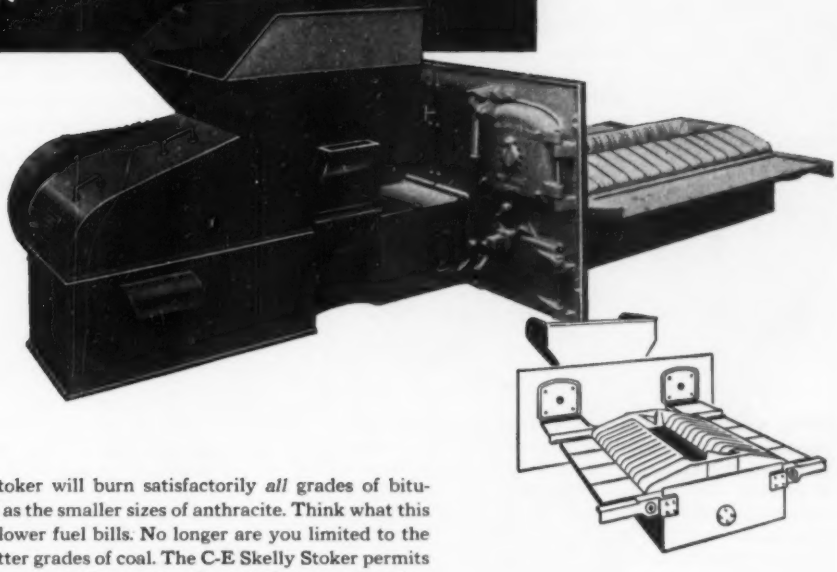
# Why not buy a stoker that will burn either...

## *Anthracite or Bituminous Coal?*



The C-E Skelly Stoker will burn satisfactorily *all* grades of bituminous coal as well as the smaller sizes of anthracite. Think what this means in terms of lower fuel bills. No longer are you limited to the more expensive, better grades of coal. The C-E Skelly Stoker permits the use of the most economical type of coal available in your locality. This flexibility in the choice of coals enables you to keep your heating costs at a minimum. In fact, it makes your purchase an investment rather than an expense.

For, since the cost of fuel burned on a stoker in a single year often greatly exceeds the initial cost of the stoker itself, it is evident that *what kind* of coal a stoker will burn and *how well* it will burn it is a far more important consideration than the purchase price.

Moreover, the C-E Skelly Stoker assures top performance with minimum maintenance. For this stoker reflects the practical knowledge of fuels and operating conditions that Combustion has acquired in installing over 20,000 stokers of *all* types above residence size.

You can turn to C-E with complete confidence that you are purchasing a stoker that you can rely on for years of dependable, economical service. Why not investigate the C-E Skelly Stoker for your next installation? B-362

C-E

**COMBUSTION ENGINEERING-SUPERHEATER, Inc.**

A Merger of Combustion Engineering Company, Inc. and The Superheater Company

**200 Madison Avenue • New York 16, N. Y.**

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS.

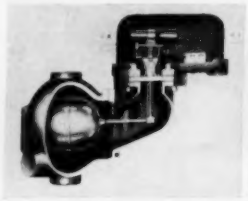
[*Continued from p. 163*]

Of standardized design and construction, each unit consists of a fan section—with two backwardly inclined blade "Silentvane" type fan wheels mounted on a common shaft—and a coil section with drain pan for cooling and heating coils, depending upon the requirements. Filter sections, face and bypass dampers, and other accessories are available.

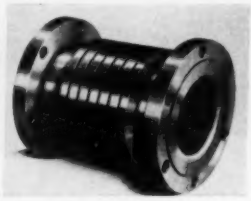
**HPAC 4316—EXPLOSIONPROOF FLOAT CONTROL**—A new No. 65 explosionproof, float operated electric controller for water tanks, receivers, and other liquid storage systems has been developed by McDonnell & Miller, Inc., Wrigley Bldg., Chicago 11.

Featuring packless construction, a mercury switch and enclosed wiring and terminals, it is furnished with a switch that either makes or breaks the circuit with a falling liquid level. The float chamber is of cast iron; the float is copper; the float rod is brass; and bellows are bronze. Maximum body pressure is 40 psi.

Recommended for controlling motors, signal lamps, electrical elements, etc., it is designed for use in atmospheres containing ethyl-ether vapors, ethylene, cyclopropane, gasoline, butane, propane, alcohols, acetone, benzol, lacquer solvent vapors, or natural gas.



Float Control



Expansion Joint

**HPAC 4317—EXPANSION JOINTS**—"Flexoniflex" high pressure expansion joints of Chicago Metal Hose Corp., Maywood, Ill., consist of corrugated bellows type sections of stainless steel or other alloys formed within integral control rings and end sections. The rings are not bolted in place but are designed to have intimate relationship with the pressure carrier. This refinement of construction, plus the design of the convolution wave and controlled manufacturing processes, is said to qualify these expansion joints for extremely high pressures.

Standard units are offered with single or multiple plies and may be lined or unlined, depending on the application. Sizes begin at ⅝ in. ID and continue through the range of high pressure pipe sizes. The temperature range is from subzero to 1400 F for stainless steel. According to the firm, this upper limit can be exceeded with special alloys. Working pressures of 1000 psi have been set up as a base standard, though this is said to be an arbitrary figure as units have been designed for higher pressures.

Joints for absorbing radial and offset motion, as well as axial motion, are available.

**HPAC 4318—SHEAVES**—Extension of its "Magic-Grip" sheave line to include A-B combination groove sheaves in sizes from 3 to 38 in. (one to six grooves) in both collar and no collar types has been announced by Allis-Chalmers Mfg. Co., Milwaukee.

Both the collar (style C) and non-collar (style NC)


# THE RIGHT ALLOY
## is the Right Answer to Many Piping Problems

Until recently, piping engineers were limited in their choice of piping materials to carbon steels, a few low alloy steels, wrought iron, cast iron and brass.

Today, thanks to metallurgical research and new welding techniques—many more materials are available, including intermediate and high alloy steels containing chromium, nickel, or both . . . commercially pure nickel . . . copper . . . aluminum . . . and alloys in which nickel, copper or aluminum is the major constituent.

Rapid corrosion of piping by the fluid handled, or contamination of the fluid by corrosion of the pipe—or by catalytic action of the pipe material with the fluid, are problems which today's piping engineer faces. Often, these problems are complicated by pressures and temperatures at which the fluid must be conveyed, or by wide fluctuations of pressures and temperatures when the process is cyclic in nature.

Each of these service conditions demands utmost care in the selection of the piping material.

Tube Turns, Inc. is constantly studying all of the factors involved in the application of alloy materials to piping systems. Today the ever-expanding line of Tube-Turn Welding Fittings includes more than 40 different alloys in both ferrous and non-ferrous classes . . . to help solve *your* piping problems.

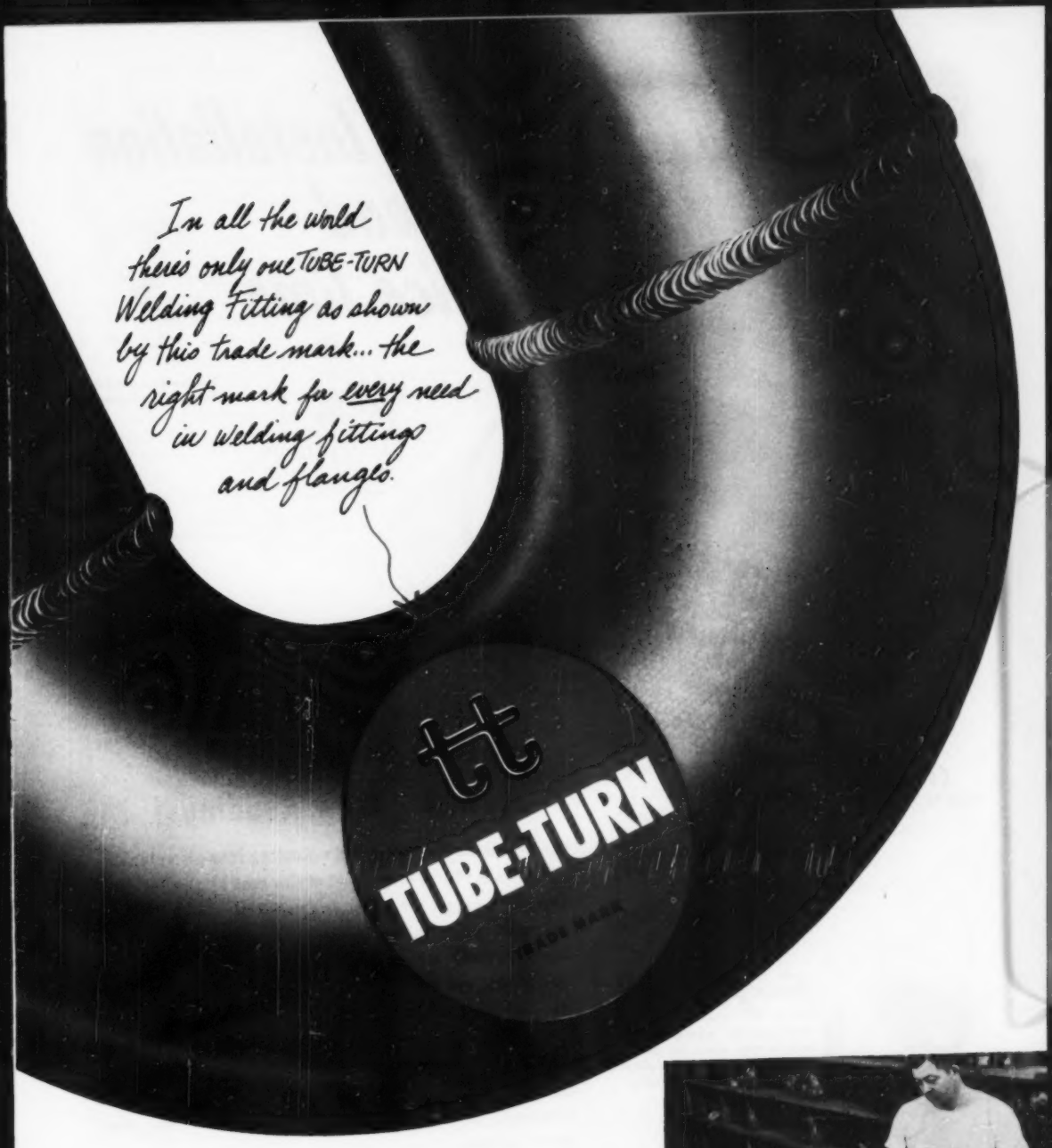
**FREE BULLETIN**

Write today for your free copy of "Special Alloys", a bulletin containing valuable information of Stainless Steels, Nickel and Nickel Base Alloys, Copper and Copper Base Alloys, and Aluminum and Aluminum Base Alloys. Discusses physical characteristics, service conditions and gives chart of sizes and wall thicknesses available.

"Be Sure You See The Double tt"

**TUBE TURNS, INC.**

LOUISVILLE 1, KENTUCKY

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Thermo-Anemometer checking baseboard convector

Thermo-Anemometer in refrigerated space

Thermo-Anemometer check draft in room corner

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THERMO-ANEMOMETER

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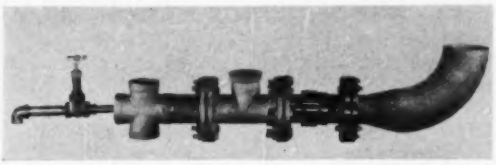
types operate on the same principle of clamping the sheave quickly and firmly to the shaft by compressing the split tapered bushing sleeve.

The noncollar bushing is a new development. It has radially adjusted setscrews and is especially designed to allow maximum bores in the smaller pitch diameters. The sheave itself has four radial screw holes in the hub, two at 180 deg marked "on" and the opposite holes marked "off." Two hexagon socket cone point setscrews, operating in cone shaped recesses, tighten or release the bushing from the shaft, depending upon their position in the holes. It is available only in the smaller pitch diameters.

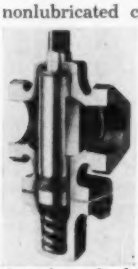
The collar type bushing is the original "Texrope" drive featuring the tapered split bushing with separate collar and axially adjusted capscrews. The sheave is clamped to the shaft by tightening three capscrews. It is released by loosening the capscrews and using two of them as jackscrews.

**HPAC 4319*—STAINLESS STEEL VALVES, FITTINGS**—The composite assembly shown here illustrates the types of corrosion resistant fittings, valves, pipe, and tubing now offered by Tri-Clover Machine Co., Kenosha, Wis.



All of the fittings in this group are of stainless steel and include "Zephyrweld" welding fittings, flanged conical end fittings, recessed end fittings (for soldering, brazing, or socket welding), both screwed and flanged IPS fittings, and IPS valves, adapters, and piping.

**HPAC 4320—INDUSTRIAL CONTROL VALVE**—A nonlubricated cylindrical plug industrial control valve, designed to provide leakproof shutoff while eliminating contamination, has been developed by Belfield Valve Div., Minneapolis-Honeywell Regulator Co., 435 N. Broad St., Philadelphia 23.



The new design includes a permanent seal at the plug stem, sealing packing at the base of the plug, and a fixed-load spring, combined with a close dimensional tolerance.

Torque tests, says the company, show that the cylindrical valve's greatest torque requirement, about 250 in.-lb at a line pressure of 250 psi, is equivalent to a force of only 12-½ lb acting on a lever arm 20 in. long.

**HPAC 4321—WINDOW TYPE CONDITIONER**—A new 1 hp air conditioner of the window type is being marketed by Frigidaire Div., General Motors Corp., Dayton 1, Ohio. Incorporating two separate "Meter-Miser" refrigerating systems, it also features streamlined package design and styling, re-

Power-laden Btu's are odds-on-favorites to escape whenever inadequate or no insulation affords the opportunity.

Keep Btu's on the job with efficient, fuel-saving CAREY Industrial Insulation. Cut production costs—raise efficiency—improve employee morale, save fuel!

*And now—a new improved insulation*

CAREY TEMPCHEK

a specialized product with a wide temperature range up to 1500°F, low K factor, rugged strength, excellent "Handle-ability"—

*a combination of outstanding qualities . . .*

***Ask about it!***

Don't let Btu's get the jump on you! Call in your CAREY representative today—he's a trained expert, eager to serve you.

**CAREY Makes the Complete Line!**

**85% Magnesia—Industrial Rock Wool—Asbestos—Pipe Coverings—Sheets—Blocks—Batts—Papers—Air-Cell.**

Write for your free copy of "Heat Insulation For Industry." Address your request to Dept. H-4, The Philip Carey Manufacturing Company, Cincinnati 15, Ohio. In Canada: The Philip Carey Company, Ltd., 1557 MacKay Street, Montreal 25, P. Q.

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INDEPENDENT

"Fabrikated" WALL GRILLES for Commercial Installations

*PROVIDE ADJUSTABLE DIRECTED AIR FLOW

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UP OR DOWN

RIGHT OR LEFT

311-A

Made to fit openings in even inches from 8" x 4" to 60" x 40"

Independent Fabrikated* Adjustable Grilles (patented), rigidly constructed with stamped steel rims and steel bars, are made with either vertical or horizontal grille bars. Grille bars are *adjustable* before or after installation; available also with bars permanently set for straight flow.

*Write for new Catalog No. 48—gives schedule of sizes, details and prices.*

*Always Leading — Always Progressing*

*Reg. U. S. Pat. Off.

THE INDEPENDENT REGISTER CO.

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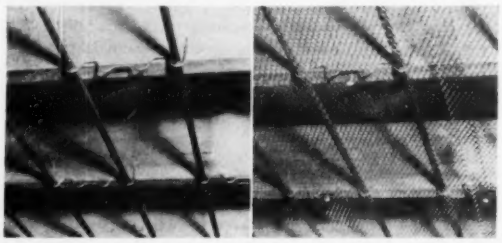
cessed control dials, and a grille with adjustable louvers.

The air filter slips out through the bottom and air is drawn in through the bottom of the unit which is designed to cool, dehumidify, filter, and circulate air. The conditioner, says the company, can be installed in less than an hour and is ready to run with a plug-in connection.

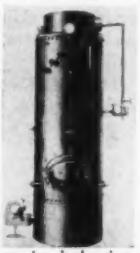
**HPAC 4322**—TUBE HANGERS**—The new tube hangers of Kynex Co., 21 West St., New York 6, are designed for use with radiant heating installations. Driven into joist faces, the hangers are used to support tubes to the underside of the joists.



Advantages are said to include accurate spacing of rows of tubes which are kept in alignment, savings in coil installation time, and the holding of standard metal lath in a level plane against upward movement when plaster is applied.

Hangers accommodate various sizes of tubes on 4 in. and 6 in. centers and are said to be suitable for use on any joist size and spacing. Nails are not required.

**HPAC 4323—STEAM BOILER-BURNER UNIT**—The industrial division of York-Shipley, Inc., 34 Jessop Pl., York, Pa., has added a new line of low cost vertical, tubular boiler-burner units in sizes from 3 to 15 hp. Equipped with the firm's gun type oil burner, automatic controls, condensate return system, and draft adjuster, units are designed for pressures up to 100 psi.



Boilers are full length riveted and constructed in accordance with the ASME code. Furnished complete with base, combustion chamber, and trim, they are especially recommended for use in bakeries, laundries, cleaning and pressing plants, canneries, dairies, and for many industrial processing requirements in numerous plants requiring quick steam.

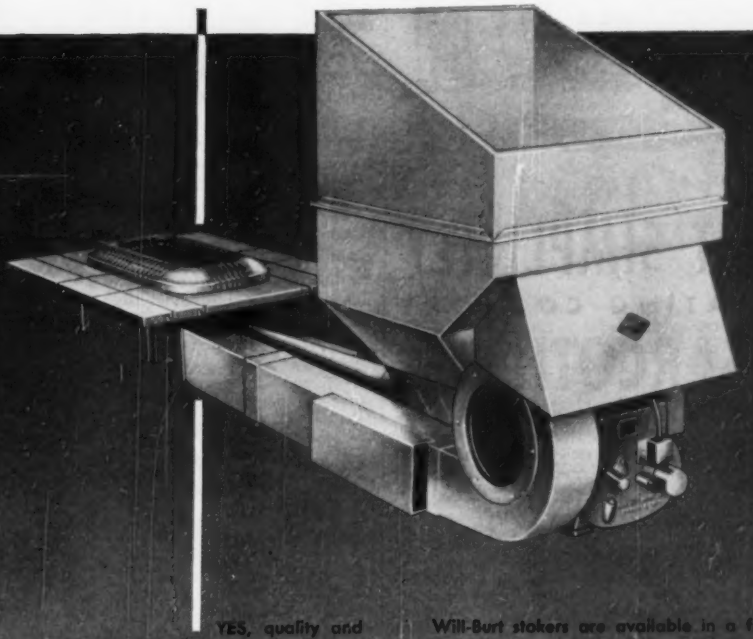
**HPAC 4324*—ROOM DEHUMIDIFIER**—A new dehumidifier has been developed by Airtemp Div., Chrysler Corp., 1600 Webster St., Dayton 1, Ohio.

The new unit, designed for home or office use, consists of a hermetically sealed compressor which cools a series of coils below room temperature. Air is drawn over the coils by a fan, cooling the air and causing moisture to condense into drops of water which are retained in a removable receptacle. The dehumidifier is said to be capable of reducing excessive humidity in enclosed spaces up to 13500 cu ft.

Aluminum finned tubing is used for the evaporator and condenser coils. The compressor, a 1/5 hp reciprocating type, is completely sealed in steel shells by electric weld-

*Quality-wise* means PROFIT-WISE...

that's why WILL-BURT means MORE PROFIT



YES, quality and profit go hand-in-hand—for only by providing product of the highest quality can a heating contractor, dealer or distributor hope to develop the good will which makes his customers recommend him to their friends.

That's why Will-Burt heating folks "stay put"—because the quality of Will-Burt stokers and other heating products keeps customers happy—and because Will-Burt's time-tested dealer policy is friendly, helpful, considerate.

Will-Burt stokers are available in a full range of styles and sizes, in capacities up to 600 pounds per hour. Backed by more than 50 years of manufacturing experience—more than 20 years in designing and manufacturing bituminous coal stokers—a Will-Burt stoker will provide the safe, sure, efficiency you'll need for your next installation.

May we send you more information?

**OTHER WILL-BURT HEATING PRODUCTS**

Oil and gas conversion burners.
Residential hot-water heating boilers.
Coal, gas and oil-fired warm-air furnaces.

WILL-BURT

**THE WILL-BURT COMPANY**

DEPARTMENT H ORRVILLE, OHIO

# UTMOST SIMPLICITY
## AND HEATING COMFORT
## *with* SARCOTHERM

The heart of the Sarcotherm System is a simple mixing valve which has been proven in service for a quarter of a century. The mechanisms are strictly mechanical — no electricity or compressed air. Nothing could be simpler or more dependable.

**NO "COLD SEVENTIES"**

and no "on and off" control with Sarcotherm. It's a simple proportioning three way valve that mixes hot water from the boiler with the cooler return water, giving modulated control at all times.

**RADIANT HEAT**

Continuous circulation with modulated control is ideal. Inside control is by the exclusive Sarcotherm heat-loss thermostat. Thirty years of experience with Radiant Heating is built into every Sarcotherm job.

**CENTRALIZED PANEL CONTROL SYSTEMS**

Sarcotherm has available completely automatic centralized panel control systems for apartment houses, schools and other public buildings. Complete control programs furnished to suit particular requirements.

Architects and Heating Engineers like Sarcotherm because it is so flexible. Split systems, automatic night set-back and morning pick-up are easily arranged. Lower boiler temperatures, less fuel used and invariably a lower cost of installation, make Sarcotherm the ideal for engineers who are in daily competition.

*Ask for the new catalog, engineering data and sales helps.*

Sarcotherm

SARCOTHERM CONTROLS, INC. • Empire State Bldg. • NEW YORK 1, N. Y.

17

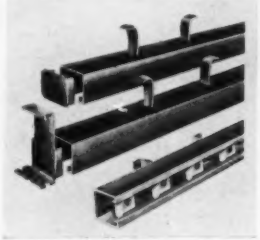
ing. Moving parts are partially submerged in oil and all bearing surfaces are pressure lubricated.

While a 12 quart galvanized container is provided to catch water removed, the unit can be permanently connected to a drainpipe or placed over a floor drain.

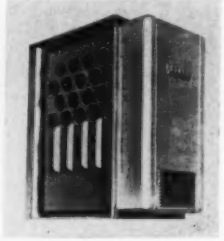
**HPAC 4325—CONCRETE INSERT**—A new low cost concrete insert for anchoring hangers, brackets, supports, etc. for piping, ductwork, and equipment has been placed on the market by Unistrut Products Co., 1013 W. Washington Blvd., Chicago 7.

According to the company, attachments are easily made at any point along the channel without disturbing other attachments. This is accomplished by the insertion of a spring nut into the channel (at the point where attachment is desired) and bolting to the fitting. This bolting action secures the nut to the "double track" formed by inturned edges of the channel.

Known as the series P-3000, these inserts are available in stock lengths from 3 in. to 20 ft and are offered with plain drive-in end caps or anchor type drive-in end caps equipped with slots for centering and nailing. The channel is of 12 ga cold rolled steel and comes in a choice of several finishes. Load capacity is said to be 2000 lb per ft, with a safety factor of 3.



Concrete Insert



Duct Heater

**HPAC 4326—GAS FIRED DUCT HEATER**—Now ready for shipment from Reznor Mfg. Co., Mercer, Pa., are new automatic, concealed, gas fired duct heaters.

Suspended or base supported, they are designed for use with any type duct system, and can be used singly or in multiples. According to the company, they may be used with air conditioning units and are designed for concealed installation along hot air routes. Direction of heat flow through the exchanger section is reversible, permitting alternate operations on different lines. Designed for easy cleaning, the entire burner chassis can be removed by loosening two bolts. Also, there's an additional cleanout opening located just under the draft diverter.

The heaters incorporate automatic controls and are approved by the American Gas Association and Underwriters' Laboratories.

**HPAC 4327—ALUMINUM INSULATION**—An aluminum thermal insulation consisting of three separated metal sheets and two fiber partitions has been put on the market under the name "Infra" type 6. It is a product of Infra Insulation, Inc., 10 Murray St., New York.

It is designed to provide six reflective spaces. The six reflective surfaces are said to have an emissivity and absorption of 3 percent. Factors for combined heat flow by

# . . . and now
# The HORIZONTAL
# Brundage AIR-RENEWER

**FRESH AIR CLEAN AIR—PROPERLY HUMIDIFIED—BACTERIA FREE**

For the forced warm air furnace a ceiling type (horizontal) Air-Renewer has been created. Air humidification, purification and cleaning can be had by installing the glycol-filter compartment unit (illustrated below) with any heating or cooling system where a blower is already an integral part of the system. It is completely factory assembled, space saving and dollar saving to your customer. This low cost, easily installed unit, employs a simple, positive, trouble-free mechanical process.

Get all the facts now about this fast-growing market. Learn how you can make bigger profits in 1950 installing complete indoor living comfort — the Brundage Air-Renewer!

**AIR CIRCULATION**

Where a blower is not part of the system a 700 Series Vertical Model (Floor Type) may be used, or a matching blower compartment may be added to the horizontal Air-Renewer.

HORIZONTAL
Model 1713GL
AIR-RENEWER

**Brundage COMPANY**

*Blower Specialists Since 1919*

541 NORTH PARK STREET
KALAMAZOO 11, MICHIGAN

Typical installation, with a 100,000 B.T.U. forced warm air furnace.

**Handy Helper that gives you**

*Power*

**FOR HAND PIPE TOOLS**

*Model "400" can be furnished with legs, handy tool tray, feet and all fittings at slight additional cost.*

**RIDGID Model "400"**

**...lightest power unit made**

● One man alone can move this job-tested Model "400" around on the job. Weighs just a little over 100 lbs., gives you plenty of power for hand tool threading, cutting and reaming jobs. Universal motor—forward, reverse, light socket power. RIDGID 3-jaw chuck in front with chuck wrench ejector; self-centering workholder in rear turns with pipe. Sealed-in lubrication—no oil spillage. Many thousands of Model "400" Power Drives are now in actual service. Buy one at your Supply House.

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL CO. • ELYRIA, OHIO


radiation, convection, and conduction are said to be: down-heat flow, $C = 0.044$; up-heat flow, $C = 0.080$; wall-heat flow, $C = 0.073$.

Three aluminum sheets are spaced 1¼ in. apart. Two outer reflective spaces and four inner rows of alternating, reverse, triangular reflective spaces are said to be created by two flame, mold and verminproof fiber partitions. The permeability to water vapor, says the company, is zero.

The insulation is installed in ceilings and floors, between beams, steel girders, trusses; under concrete floors and ceilings; over concrete slabs; and under or over radiant heating panels. The installation is said to require no special skill.

**HPAC 4328—BASEBOARD RADIATION**—The "Bayce Heet" baseboard radiation of Brown Products Co., Forest Hills, N. J., incorporates beaded aluminum fins which are said to provide relatively great radiating surface and to be unusually strong.

The unit is designed to protrude only 1⅛ in. from the wall and has a closed top with openings being provided on the front of the enclosure. According to the manufacturer, this arrangement prevents streaking the wall.

The baseboard unit is made up in 5 ft lengths weighing 12 lb and requiring three wall brackets for installation. Each unit can be cut to any desired length.

Baseboard Radiation

Air Meter

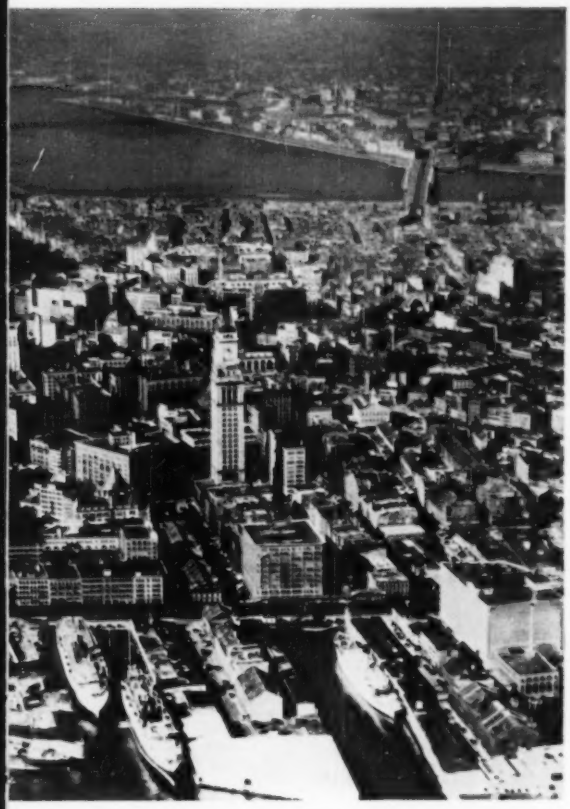
**HPAC 4329—AIR METER**—An electrical anemometer, said to be free of the effects of rate of change of temperature, is offered by Hastings Instrument Co., Hampton, Va.

The model G air meter is designed to provide instantaneous, direct readings of air velocities from 5 to 6000 fpm with an expanded scale in the low velocity ranges. It is offered with built-in temperature compensation to prevent momentary error in velocity reading when the probe is subjected to sudden changes of temperature. The new unit is recommended for use in the air conditioning industry, in process control, and in research installations in which it is desired to obtain readings quickly.

**HPAC 4330—INSULATION FASTENER**—A new "speed clip" to fasten insulation permanently to sheet metal roofs, walls, etc. without adhesives is offered by Tinnerman Products, Inc., 2035 Fulton Rd., Cleveland.

The new fastener, which can be used to secure insulation to air conditioning duct work, is driven like a nail through the insulation and into the metal. It has a sharp point for penetrating steel .040 to .050 in. thick and forms a barb designed to hug the radius of the sheared tab.

## American Blower—a time-honored name in air handling



**In Boston,** as in other cities, American Blower Air Handling Products have been serving commerce, industry and public utilities for over half a century. For air handling data in the Boston area, call American Blower—Liberty 8427. In other areas, consult your phone book.

**There's a** big difference in quality, design, quietness, operating costs and efficiency between American Blower and ordinary air handling equipment. It pays to look before you buy! Comparative tests by buyers have thoroughly proved the superiority of American Blower Air Handling Equipment.

# Air is free . . . use it profitably!

MODERN business men consider air a natural resource, like iron and coal. They put air to work at a profit.

You can profit, too, by better use of air.

Could you profit by installing modern ventilating equipment? Have you a process requiring washed air? Ever thought of handling materials with air? Can you benefit by modern units which force heated or conditioned air into work areas?

Since 1881, American Blower has been building air handling equipment for America's commerce, industry and public utilities.

Today, American Blower products are preferred by industry because of their high quality and their proved ability to operate at a lower cost.

If you would like to know how these products can be profitably applied to your business, or how you as a contractor can profitably apply them to business and industry, phone our nearest Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

YOUR BEST BUY

**AMERICAN BLOWER**

AIR HANDLING EQUIPMENT

*Serving home and industry*

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

# Now... Yoloy Pipe

## CONTINUOUS WELD

### for use where corrosion is a problem

FOR fifteen years, Yoloy steel has been manufactured as Seamless pipe, sheets, plates and structural members. Yoloy is used in the oil, mining, railroad, chemical, trucking and other industries where resistance to corrosion and abrasion are a problem and lighter weight construction is important. Now this same unique nickel-copper low-alloy steel is available as continuous weld pipe.

Yoloy continuous weld pipe has these outstanding characteristics:

1. It is easy to weld,
2. It bends and fabricates readily,
3. Its tensile strength is high,
4. It is resistant to abrasion,
5. Its resistance to shock and vibration is high,
6. It is high in corrosion resistance.

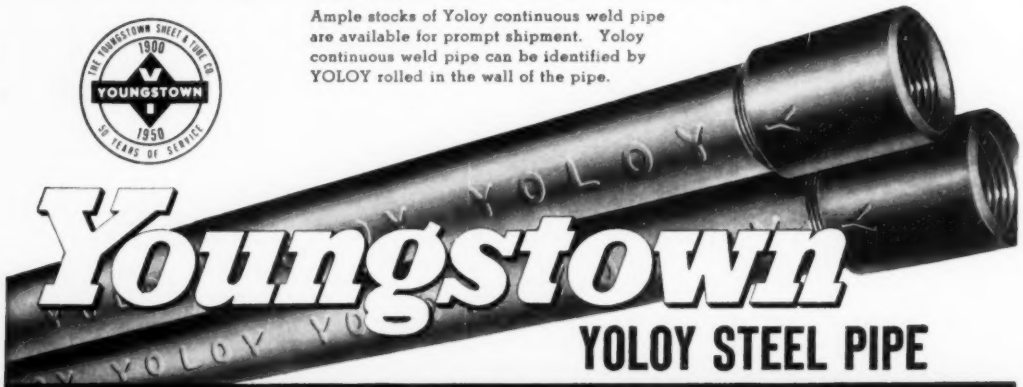
Yoloy has an atmospheric corrosion resistance from four to six times that of regular carbon steels. Its resistance to many other corrosive elements likewise is high, making Yoloy pipe particularly well adapted for use in the railroad, oil, mining and chemical process industries. Youngstown Yoloy continuous weld pipe also affords distinct advantages for use where piping is concealed in industrial plants, commercial buildings and residences.

For example, at a sewage plant, Yoloy pipe immersed in the sour sludge of a digester was found to be in good condition after nearly four years. When repairs were made to replace a mild steel tripod holding the pipe after only one year's service, it was found that the tripod had been almost entirely eaten up by the acid sludge.

Yoloy continuous weld pipe installed in brine lines from the wells at a salt plant is still in service after several years. Pipe previously used in this same line had to be replaced 3 or 4 times a year.

Other examples of the unusual service given by Yoloy pipe can be cited. For further information, write or phone the Youngstown District Sales Office nearest you.

Ample stocks of Yoloy continuous weld pipe are available for prompt shipment. Yoloy continuous weld pipe can be identified by YOLOY rolled in the wall of the pipe.




# Youngstown

## YOLOY STEEL PIPE

**THE YOUNGSTOWN SHEET AND TUBE COMPANY**

*Manufacturers of Carbon, Alloy and Yoloy Steel*

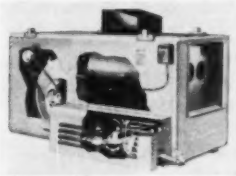
General Offices — Youngstown 1, Ohio

Export Office - 500 Fifth Avenue, New York

PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS
SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RAILROAD TRACK SPIKES

Box flanges are used to add rigidity and make it impossible to drive the clip too far into the steel. It is produced in three sizes, for insulation ½, 1, and 1-3/16 in. thick.

**HPAC 4331—GAS FIRED AIR HEATER**—The new type 151 "Climatrol" of L. J. Mueller Furnace Co., 2005 W. Oklahoma Ave., Milwaukee 15, is a gas fired, blower type unit heater available in four sizes from 60,000 to 150,000 Btu per hr input. It is recommended for use in stores, offices, schools, and commercial applications where a blower type air heater is preferred.



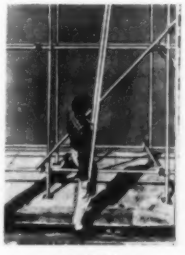
The updraft, tubular heat exchanger is of all-welded steel construction with a high crown sheet designed to eliminate flame impingement. The cast iron, raised drill port burner is said to provide instant ignition without cross lighting problems. The centrifugal blower is located at the rear of the unit and is mounted on rubber. Cleaning is said to be accomplished from either the top or bottom of the heater which is equipped with support channels for setting and also hanging brackets for suspended installation.

**HPAC 4332—MANUAL MOTOR STARTER**—The new "Motor Sentinel", a manual motor starter with bimetallic overload protection, is available from the Westinghouse Electric Corp., Box 2099, Pittsburgh 30.

Especially designed for controlling and protecting small motors used with fans, pumps, small machine tools, grinders, stokers, etc., the starter fits any standard 2½ in. wall box. With a front-removable heater of the proper rating, it is said to permit time delay for starting and allow motors to carry overloads up to their safe capacity without disconnecting them from the line.

For surface mounting, the starter is available in an alloy enclosure with bonderized baked enamel finish. Special cast iron enclosures are provided for watertight and explosionproof applications. Positive operation, says the manufacturer, is provided by means of the overcenter toggle mechanism. Double break silver contacts and copper alloy or plated steel parts are used.

Motor Starter



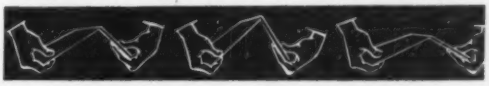
Scaffold

**HPAC 4333—ALUMINUM SCAFFOLDS**—According to Up-Right Scaffolds, 1013 Pardee St., Berkeley, Calif., its new aluminum alloy "Tube-and-Coupler" scaffolds are basically different from others on the market and are designed for heavy construction work and industrial maintenance.


# ·· FOR · USERS · OF ·· EXPANSION JOINTS:

***a lesson in simple mechanics . . .***

**Flex . . . metal . . . *like* . . . *this***

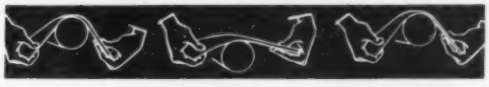


**. . . and . . . something's . . .**

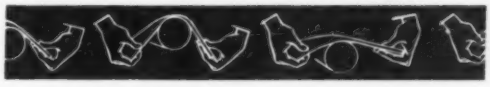
**bound . . . to . . . *"give"***

**Do . . . it . . . *like* . . . *this* . . . and**

**. . . you . . . can . . . go . . . *on* . . .**

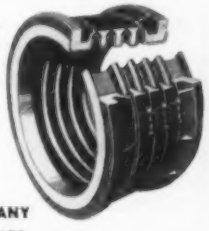


***and* . . . *on* . . . *and* . . . *on* . . .**



Yes, it's a simple principle, one you know — and one you should keep in mind when buying an expansion joint. For this is, in fact, the principle underlying the all-curve construction of a Badger Directed Flexing Packless Corrugated Expansion Joint. As the illustration shows, the movement of the corrugated member of a Badger Joint is controlled and contained so that it *always follows a curved pattern* . . . no corners or angles where stresses can localize . . . no excessive strain . . . no chance of breakdown.

For economy's sake remember this important feature when you specify . . . remember that it's found *exclusively* in Badger Directed Flexing Packless Corrugated Expansion Joints.



**Badger**

MANUFACTURING COMPANY

230-260 BENT ST., CAMBRIDGE, MASS.

NEW "PRV" MODEL
Power Roof Ventilator
(DIRECT-DRIVE CENTRIFUGAL FAN TYPE)

10 SIZES
to operate against resistances
from ¼" to 1½".

ILG VENTILATION

ILG-designed, ILG-built for efficient, trouble-free exhaust from vertical flues in multi-story buildings or from duct systems. BC type load-limiting centrifugal fan wheel with space-saving direct-drive. Vertical type ball-bearing motor of proven ILG design. Weatherproof housing . . . leak-proof construction. Available with automatic or motor operated shutter, or combination shutter and variable air controller. Easily installed . . . wired . . . serviced. ILG "One-Name-Plate" Responsibility covers entire unit including motor. Call nearby branch office (consult classified directory) or send coupon for FREE bulletin.

PASTE ON PENNY POSTCARD AND MAIL TODAY

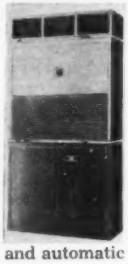
ILG ELECTRIC VENTILATING CO.
2841 North Crawford Avenue, Chicago 41, Illinois
Offices in more than 40 Principal Cities

☐ Please rush FREE BULLETIN on new ILG "PRV" Model Power Roof Ventilators.

Firm Name.....
Executive's Name.....Title.....
Address.....Zone.....
City.....State.....

Numerous labor saving features are said to include the relatively short erection and dismantling time required. This is said to be provided by its light weight, the use of swivel base plates which require no wedging, new couplers, locking tubes, and swivel plates. Other features stressed by the manufacturer are: relatively low transportation time and cost, high load-carrying ability, (over 75 lb per sq ft, with a safety factor of 4), resistance to corrosion, and the ability to withstand relatively high impact load.

**HPAC 4334—PACKAGED AIR CONDITIONER**—The addition of an 8-ton unit to its line of packaged air conditioners has been made by Airtemp Div., Chrysler Corp., Dayton 1, Ohio.



In incorporates the company's sealed radial compressor which is cushion mounted and sealed in a bath of oil. The "Maxi-Fin" cooling coil is said to offer unusual heat transfer per pound of weight. Two centrifugal type fans are used on this unit, both of which are mounted on sponge rubber to reduce vibration. Adjustable sheave motor pulleys are used so the fan speed can be regulated, and automatic low voltage and overload protection are built-in. The fans may be operated separately for ventilation when cooling is not required.

All connections, including the automatic thermostat, may be concealed within the cabinet. An optional remote thermostat may be used if desired and a heating coil and a humidifier are available as optional equipment.

**HPAC 4335—FUEL OIL HEATER**—A new "Thermo-syphon" fuel oil heater equipped with an expansion tank and designed to preheat fuel oil to improve atomization of oil at the burner has been introduced by Yula Water Heaters, Inc., 166 W. 225th St., New York City.

The unit is designed for use as a "below water-line heater" in oil fired installations where there is no need for maintaining the boiler at steaming conditions throughout the year. It is for use with No. 6 C fuel oil.

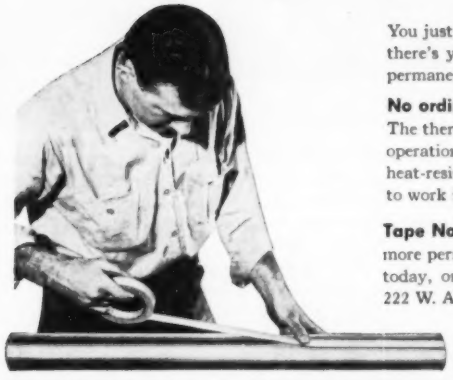
In operation, fuel oil flows through the tubes in the upper heater and boiler water flows through tubes in the lower heater. Secondary water circulates through the shells of each heater. The arrangement of shells and circulating lines is said to cause uniform circulation of secondary water over all tube surfaces, resulting in rapid transfer of heat.

**HPAC 4336—ALUMINUM PIPE WRENCH**—The aluminum pipe wrenches of J. H. Williams & Co., 400 Vulcan St., Buffalo 7, are drop forged from aluminum alloy and are heat treated for strength and toughness. According to the company, the strength and long wearing qualities are comparable to iron or steel wrenches. Ease in handling and reduction in worker fatigue are said to be the result of light weight.

The replaceable alloy steel, cadmium plated jaws inserts are interchangeable, the same insert fitting into the handle and the movable jaw. The steel adjusting nut is case hardened, knurled, and cadmium plated.

**IN JUST 15 SECONDS...**

# Seal Pipe Completely, Permanently with Polyken® Self-Vulcanizing Tape No. 290



You just strip POLYKEN No. 290 around the pipe seam, cut the roll loose—and there's your seal, neat and secure, *in less than 15 seconds!* The result is a permanent, *vulcanized* seal that actually improves with age!

**No ordinary tape,** No. 290 was engineered especially for sheet metal work. The thermo-setting adhesive actually vulcanizes itself firmly to the metal under operational temperatures. And the tough, strong **Fiberglas*** back is lastingly heat-resistant. Tape No. 290 comes in convenient 1½" x 36 yd. rolls, ready to go to work immediately.

**Tape No. 290** adds to structural strength, too! It's cleaner, quicker, cheaper, more permanent—and amazingly efficient! For more details, phone your jobber today, or write Polyken Industrial Tape, Department D-4, Bauer & Black, 222 W. Adams Street, Chicago 6, Illinois.

**EIGHT REASONS WHY TAPE No. 290 SEALS PIPE BETTER**

**Seals Pipe Swiftly, Safely, Permanently • Sticks Fast to Any Sheet Metal**
**Absolutely Non-Corrosive • Greatly Increases Structural Strength of Joints • Simplicity Itself. A Single Material—a Single Size**
**No Paste, No Brush, No Mixing, No Mess • Clean, Neat, Permanent • Actually Costs Less to Install in Many Applications**

*Reg. U.S. Pat. Off. (By the Owens-Corning Fiberglas Corp.)

**Polyken®**
**INDUSTRIAL TAPE**

DEPARTMENT OF
**BAUER & BLACK**
DIVISION OF THE KENDALL COMPANY
222 W. ADAMS ST., CHICAGO 6

Compare the low height and streamlined appearance of Power-Flow with other ventilators. Power-Flow's modern design blends well with any style architecture.

CONTROLLED VENTILATION
*Plus*
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The DeBothezat Power-Flow Roof Ventilator is a motor-driven fan in a weatherproof housing. It provides CONTROLLED ventilation at all times, regardless of outside weather conditions. These rugged, efficient ventilators deliver up to 40,900 CFM. They exhaust more air per brake horsepower than other ventilators, are quieter in operation and more economical in first cost. Non-overloading power characteristic prevents motor burn-out. DeBothezat Power-Flow Roof Ventilators can be used with or without duct system. Available with fan wheels from 16" through 48" in diameter.

ALL PARTS EASILY ACCESSIBLE

Power-Flow Roof Ventilators, sizes 16" through 36" are hinged in two places, for easy inspection and lubrication. Larger models (42" and 48") permit access to fan, shaft and motor by means of easily removable door.

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DE BOTHEZAT FANS DIVISION
American Machine and Metals, Inc.
East Moline, Illinois

Power-Flow
ROOF VENTILATORS

**HPAC 4337**—AIR FILTER**—A new oilless, cleanable air filter, known as "A-Lum-O," is made of aluminum wool fibers packed in graduated density in an aluminized steel frame. According to Bard Mfg. Co., Bryan, Ohio, features include safety from fire hazard, lifetime service, and elimination of replacement cost.

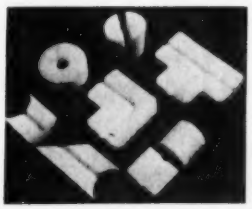
Offered in virtually all common sizes, filters utilize aluminum fibers which are triangular in cross section.

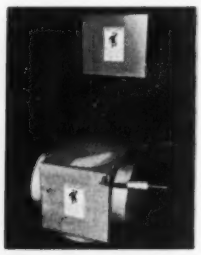
**HPAC 4338—COLD PIPE INSULATION**—A light weight pipe and vessel insulation, known as "K-Shield," has been developed by Robinson Industries, Coleman, Michigan. It is said to be especially suited for cold pipe insulation.

According to Dow Chemical Co., the insulation is made of "Styrofoam", an expanded plastic containing thousands of minute closed-wall cells.

Weighing approximately 1¼ to 1½ lb per cu ft, it is said to have high water vapor resistance and unusual resistance to mold growth, rot, and decay. It can be cut and fitted with ordinary tools and no vapor seal coating is necessary.

This insulation is being used in cold storage units, chemical processing plants, oil refineries and in special applications on pipe lines where temperatures range from 175 F to —250 F. It is manufactured for all standard pipes and fittings and custom fabricated to specifications for insulating process equipment such as tanks, pumps, accumulators and other nonstandard items.





*Above:* Pipe Insulation
*Right:* Draft Regulator

**HPAC 4339**—OIL BURNER DRAFT REGULATOR**—The "Thrift-O-Matic" draft regulator has been designed for use with small industrial oil burners of the gun and rotary types. The manufacturer is Engineered Products Co., 6121 Morton St., Philadelphia 44.

Furnished with an electric control unit, the device has two separate functions. During burner operation, it is used to provide a baffling effect so as to insure a steady draft in an amount sufficient for efficient combustion. During the "off" period, an automatic shutoff feature is used to close off 80 percent of the equivalent cross sectional flue area. An air inlet in the device is regulated during both "on" and "off" periods to admit secondary air to the stack.

**HPAC 4340—LOW CARBON STAINLESS STEELS**—Carnegie-Illinois Steel Corp., United States Steel Corp. Subsidiary, Carnegie Bldg., Pittsburgh 30, is now prepared to produce low carbon stainless steels which are said to be especially useful in industry.

Up to the present, says the company, it has been necessary to add columbium or titanium to austenitic stainless steels as "stabilizers" to minimize the adverse

# JUST OUT!

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# GUIDE

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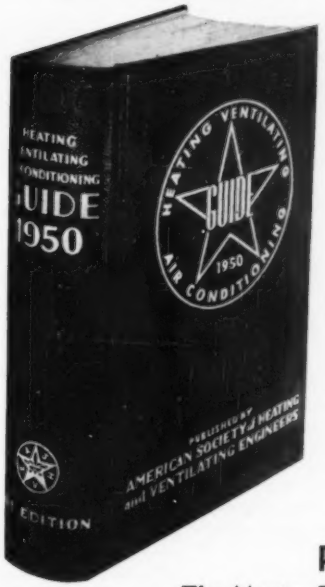
You, too, should use this storehouse of information which will prove so useful whenever you have any problem relating to Heating, Ventilating and Air Conditioning.

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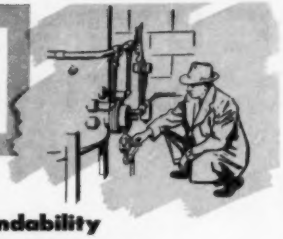
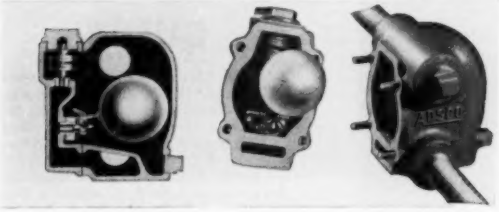


**how to get maximum dependability with minimum maintenance**

## DUAL STEAM TRAPS

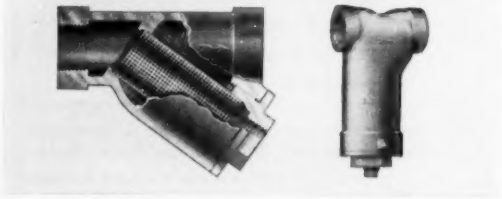
***Dual Connections — Dual Valve and Seat***



ADSCO's special design and construction features provide dependable, efficient operation, longer service life, and economy in installation and maintenance. Inlet and outlet connections on both sides of the body. Reversible stainless steel valve and seat double the life of the wearing parts. All working parts are mounted on the cover which can be removed without breaking pipe connections. Spare covers with valve assemblies can be installed in minutes with a minimum interruption of service. Full range of sizes. For all pressures to 125 psi. *Write for Bulletin No. H-35-87.*

## "Y" AND "T" STRAINERS

***Protect expensive equipment by preventing clogging***



It's good practice to install a strainer ahead of every trap—as well as every regulator, pump or valve. Reduces maintenance and prevents costly shut-downs. ADSCO Y- and Y-Type Strainers are expertly designed to remove dirt, scale and other foreign matter from steam, gas, air, water and oil lines. Wide range of sizes. *Write for Bulletin No. H-46-50A.*

ADSCO

EXPANSION JOINTS — HEAT EXCHANGERS
STEAM TRAPS — STRAINERS — METERS
CASING — ANCHORS — GUIDES

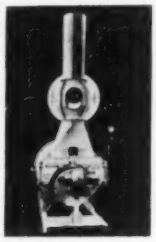
*Leaders Since 1877*

AMERICAN DISTRICT STEAM CO
NORTH TONAWANDA, N. Y.


effects of carbon and thereby render the alloy less susceptible to intergranular corrosion. The new alloys have a maximum carbon content of 0.03 percent and the 18 percent chromium and 8 percent nickel have been retained.

Development of the new stainless steel was started in 1939. Since then, extensive corrosion, welding, tensile, impact, and other physical tests have been performed. According to the firm, the low carbon stainless is suitable for many applications served by the stabilized types.

**HPAC 4341—INDUCED DRAFT BOILER FAN**—A new induced draft "Bifurcator" fan for boiler application is now being marketed by DeBothezat Fans Div., American Machine and Metals, Inc., East Moline, Ill.



The unit is a direct motor driven fan with a divided housing. The motor is in an isolated asbestos-lined chamber around which flue gases are bypassed, and the fan can be installed in a vertical stack or horizontal or angular breeching. Sizes range from 12 in. through 27 in., for boilers from 6 hp to 350 hp for operating temperatures up to 650 F.

**HPAC 4342—PIPE, DUCT INSULATION**—A new insulating material for sheet metal ducts and steam pipes has been developed by Alfol Div., Reflectal Corp., 155 E. 44th St., New York.

"Alfol" asbestos wrap is made of sheet or corrugated asbestos bonded to a sheet of aluminum foil. The sheets are fitted to pipes or ducts with a slight overlap, secured by standard insulation bands.

Light weight, ease of handling, and high thermal insulation efficiency are said to be outstanding features.

**HPAC 4343—AUTOMATIC AIR VENT**—The new No. 67 "Auto-Vent" air valve for continuous venting of hot water convector and baseboard radiators is available from Maid-O'-Mist, Inc., 3217 N. Pulaski Rd., Chicago 41. It is designed for use where space is limited, the overall size being 3 3/16 x 1½ in.

This float operated air valve requires no air chamber and is for use on hot water systems up to 30 psi pressure. It is built of nonferrous metals.

**HPAC 4344—EVAPORATIVE CONDENSER**—Kramer Trenton Co., Trenton 5, N. J., has added a 10 ton unit to its line of evaporative condensers. Designed for use with "Freon", methyl chloride, or ammonia, it can be supplied with one, two, or three independent circuits to facilitate its use with one, two, or three compressors.

The casing and sump tank are constructed of stainless steel, and the pump features a direct drive with no bearings. The pump does not require belts, packing, or greasing. The direct connected fan is placed on the air intake side in order to reduce fan corrosion. Units are designed for mounting on the floor, ceiling, or side wall and may be used either indoors or outdoors.

# How can I do a more effective job of Business Paper Advertising— *without using more money?*

TODAY many companies are faced with the need to promote new products and obtain more intensive market coverage without increasing advertising expense. And as usual Mother Necessity provides an answer—better media selection. In applying media to markets and coordinating advertising with sales plans, all investments should be made on the basis of verified circulation information in connection with dependable market data.

The facts by which the advertising value of publications may be judged are given in the reports issued by the Audit Bureau of Circulations. This cooperative and nonprofit association of 3300 advertisers, advertising agencies and publishers—

**1** **Has established standards, definitions and rules that make it possible to measure, evaluate and compare the paid circulations of published media.**

**2** **Maintains a staff of experienced and specially trained circulation auditors to audit the circulations of publisher members.**

**3** **Issues reports giving advertisers the factual information that is indispensable to economical and effective space buying.**

Included in the verified information in A.B.C. reports of business papers is a breakdown of the paid subscribers by occupation or kind of business. Thus advertisers know how much of the circulation goes to the specialized markets in which they are interested, can select media and write copy accordingly.

Other information in A.B.C. reports: How much paid circulation; how much unpaid; where the subscribers are located; what they pay for the publication; whether or not premiums are used; how many subscribers are in arrears; how many subscriptions are renewals.

It is only when media is selected on the basis of such factual information, as provided in A.B.C. reports, that advertisers can be sure of the greatest value for their advertising dollars. That is why this business paper is a member of the Audit Bureau of Circulations. Ask for a copy of our A.B.C. report and then study it.

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Paid subscriptions and renewals, as defined by A.B.C. standards, indicate a reader audience that has responded to a publication's editorial appeal. With the interests of readers thus identified, it becomes possible to reach specialized groups effectively with specialized advertising appeals.

## Heating Piping & Air Conditioning

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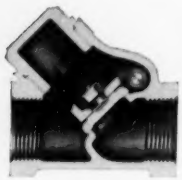
## When a valve must make its own decisions use KENNEDY Swing Check Valves

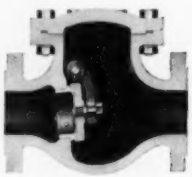
A swing check valve often guards the most vital point in your lines. That is why you will want the full assurance of KENNEDY'S seventy-three years of valve experience back of the check valves you select. When things are flowing smoothly . . . in the right direction . . . it stays open with minimum flow resistance. The moment back pressure develops it closes instantly and positively!

KENNEDY manufactures check valves in a wide range of types and sizes. Write for full details.



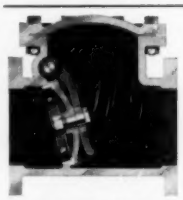
**Kennedy Fig. 492-Bronze Swing Check Valve**

Steam 300 lbs. at 550° F. Cold Water, Oil or Gas, Non-shock, 600 lbs. Generous diameter cap permits easy inspection and regrinding without removing from line. Swing disc swivels in hinge while a stop on the cap prevents sticking in open position. Sizes ½"-3".



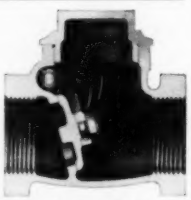
**Kennedy Fig. 889-Iron Body Bronze Mounted**

Bronze Faced Disc. Steam 250 lbs. at 500° F. Cold Water, Oil or Gas, Non-shock, 500 lbs. Revolving disc is self-adjusting. Angular placement permits easy opening at low pressures while also reducing closing shock at high back pressures. Sizes 2" to 10".



**Kennedy Fig. 106-Iron-Body Swing Check Valve**

Flanged, Bronze Mounted, Bronze Faced Disc. 2" to 12" Saturated Steam 125 lbs. Cold Water, Oil or Gas, Non-shock, 175 lbs. Has revolving, self-adjusting disc angled for easy opening at low pressure and shock reducing closing at high back pressure. Sizes 2" to 24".



**Kennedy Fig. 103-Bronze Swing Check Valve**

Bronze or Leather-Faced Disc. Saturated steam 125 lbs. Cold Water, Non-shock, 200 lbs. Also recommended for use on oil and gas lines. Leather-Faced disc should be used on cold water lines. Easy swinging disc is hinged on bronze pin . . . will not stick in open position. Sizes ¼"-4".

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**WE HEAR THAT. . . .**

**L. J. Wing Mfg. Co.**, with three separate factories in Newark, N. J., and with general executive offices in New York City, has consolidated all of these in a single modern factory building at Vreeland Mills Rd. and Fernwood Terrace, Linden, N. J. A New York City sales office is being maintained at 154 W. 14th St. The new factory and office building provides additional manufacturing facilities and there is land for future growth. However, the principal object of the consolidation is closer and more efficient interdepartmental cooperation.

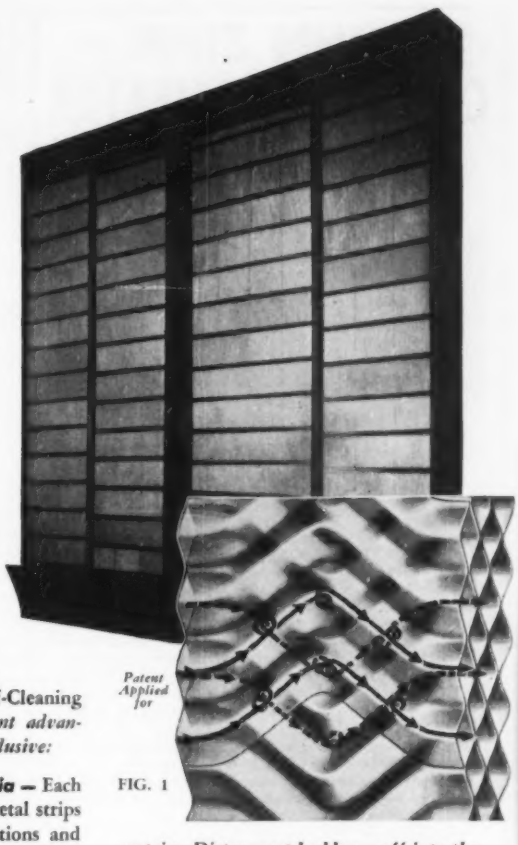
**Builders-Providence, Inc., Div. of Builders Iron Foundry**, Providence, R. I., has moved to new and larger headquarters at 345 Harris Ave., Providence 1. The move is expected to result in more efficient service to customers. At the recent 6th annual service award dinner of Builders Iron Foundry 65 awards were presented to employees. Included were 40-year service awards to Henry S. Chafee, president and treasurer, Gertrude Thurber, and Raymond Januzewski.

**A. O. Smith Corp.**, Milwaukee, in a move to enlarge its service to motor customers, has contracted with **Whirl-A-Way Motors, Inc.**, Tipp City, Ohio, to manufacture fractional horsepower motors to specification. These facilities will serve the eastern region of the country. Western states will continue to be served by the company's present motor manufacturing plant in Los Angeles. D. L. Mills, president of Whirl-A-Way, is now eastern regional sales manager of the motor division, with headquarters in Dayton, Ohio. Sales in the 11 western states are being directed from the Los Angeles plant which will also supervise sales in the southwest under Area Sales Manager George H. Nichols, with headquarters in Houston.

The tube scheduling and shipping department at the Campbell works of **Youngstown Sheet and Tube Co.**, Youngstown, Ohio, was recently presented with a bronze plaque for working two million man-hours without a disabling injury. During the period which began March 10, 1944, the department shipped approximately three million tons of pipe. ..... The special train, More Power to America Special, the first of its kind in industrial history, will be launched on a nationwide tour this spring by the apparatus department of **General Electric Co.**, Schenectady, N. Y. Exhibits of more than 2000 electrical products, processes, and techniques will be displayed through the nine cars of the train which will visit key industrial centers for inspection by industrial executives and municipal leaders. The exhibits will not be open to the general public.

**Wallingford Steel Co.**, Wallingford, Conn., claims to be in a unique position to meet individual specifications for tubing of high quality and close uniformity. Recent expansion of facilities includes the addition of new cold rolling mills and a new annealing furnace. This expansion is said to be climaxed with the addition of a new McKay tube machine. ..... **Union Malleable Mfg. Co.**, Ashland, Ohio, recently presented a gold watch to every employee with 20 years or more of service. Gifts were presented at a dinner during which J. Jacobson,

# *Compare these 3* CONTINENTAL AUTOMATIC *Self-Cleaning* AIR FILTER ADVANTAGES!



*Patent Applied for*

FIG. 1

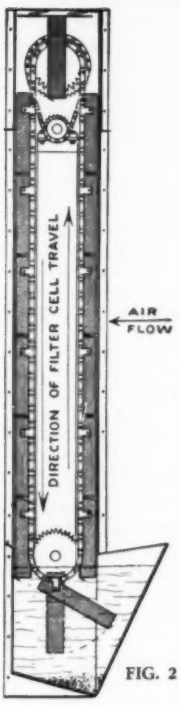



FIG. 2

**All** Continental Automatic Self-Cleaning Air Filters have *three important advantages which are completely exclusive:*

***Revolutionary New Filter Media*** — Each filter cell is composed of thin metal strips formed into compound corrugations and placed together in non-nesting relationship. Each square foot of media has 815 honeycomb openings which criss-cross the air through 2445 turbulent crossings in large, non-clogging passages (See Fig. 1). *The result is extremely high cleaning efficiency — extremely low resistance!*

***Ferris Wheel Action***—As shown in Fig. 2, the filter cells move up the front curtain and across the top of the filter assembly, with each cell swinging on an axis like a Ferris Wheel car. *The result is that air enters and leaves the same side of each filter cell, regardless of whether it is in the front or the back section of the filter curtain. Dirt cannot be blown off into the clean-air stream!*

***Positive Self-Cleaning Action*** — As each cell moves down into the oil reservoir, it soaks in oil for about thirty minutes in a semi-horizontal position. It is then released and swings into a vertical position thus causing a surge of oil through the filter media, which completely removes all accumulated dust. *The result is effective, reliable, continuous self-cleaning action!*

By every standard, the Continental Automatic Self-Cleaning Air Filter is the most advanced design on the market today. Mail the coupon to get all the facts.

**CONTINENTAL AIR FILTERS, Inc.**

CONTINENTAL AIR FILTERS, Inc.
P. O. Box 1647, Louisville 1, Ky.

Gentlemen: Please send me a copy of the *new* Continental Automatic Self-Cleaning Air Filter Bulletin No. 201-C.

Name_____

Firm_____

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# — JOHN ZINK —
# CENTRAL GAS HEATER

**(Forced Air Type)**

## Two Models Available

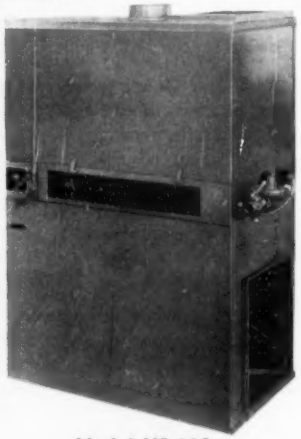
**Model AF-110**

Here is truly a universal, efficient, simple, and compact Central Heating Unit. Fully automatic, it is a complete packaged unit ready for installation. The two heaters shown are almost identical in operation and design of the heat exchanger. The two different types of casings are furnished to meet requirements for a particular application.

Heaters may be installed in the basement, artic, service closet, or utility room of a home. The AF-110 may be installed even under the house if certain provisions are made for the draft diverter. For industrial applications, it may be installed on a shelf or balcony; as a suspended heater and as a duct heater.

Each John Zink Central Gas Heater is equipped with an automatic safety shut-off that is really automatic.

The John Zink Central Gas Heater is designed as a winter air conditioner with a summer switch to provide air circulation during warm weather.



**Model HB-110**

***Write for Literature***

## John Zink Company

4401 SOUTH PEORIA

**TULSA, OKLAHOMA**

New York — Salt Lake City — Houston — Los Angeles


president, traced the growth of the firm during the last two decades. ..... **Hahn-Pitz Corp.,** Brooklyn, N. Y., has taken over the manufacture of the industrial soot blower of **Hahn Engineering Co.** The device is used for removing soot and flyash from tubes of fire tube boilers.

The wholesale activities of **Air Comfort Corp.,** Chicago, are being handled through a new organization, **Temperature Equipment Co.,** which will distribute, in the Chicago area, the air conditioning products of Carrier Corp. previously handled through Air Comfort. The new firm will also act as regional distributor for the domestic heating products of York-Shipley, Inc., the industrial oil burners of Cleaver-Brooks Co., Wilson & Co. air filters, and the window ventilators of Airgard Mfg. Co. Air Comfort Corp. will continue its retail activities and will continue to contract for the installation of air conditioning equipment.

Corrosion resistant flexible stainless steel hose is being manufactured by **Chicago Metal Hose Corp.,** 1304 S. Third Ave., Maywood, Ill. It is designed to withstand high temperatures and pressures and for conveying corrosive or searching liquids and gases where motion is required. It is fabricated in sizes from 5/16 in. through 6 in. ID in one or multiple ply construction. It is also available with helical or annular corrugations, with or without braided covering, depending upon pressure and other factors of service use. The hose is recommended for pressures up to 2000 psi, and standard pipe fittings or fittings for special requirements may be attached by silver brazing or welding.

The Bulletin 849 pneumatic timing relay of **Allen-Bradley Co.,** Milwaukee, is a new adjustable timer available for a-c or d-c operation. It utilizes a synthetic rubber bellows for controlling the tripping time and the range is adjustable up to 3 min. According to the firm, the relay resets instantaneously and is unaffected by temperature, humidity, or vibration.

A new "Thermopane" window unit is offered by **Libbey-Owens-Ford Glass Co.,** Nicholas Bldg., Toledo 3. One plate of heat absorbing glass and one of regular polished plate glass are separated by a space of "dry air hermetically sealed within the unit by a metal strip." According to the company, the heat absorbing glass, when used as the outer pane of the double glass unit, absorbs nearly half of the sun's heat, the bluish-green tint of the glass is effective in lessening glare from direct and reflected sunlight, and the double glass reduces condensation and provides insulation against cold and outside noise.

A "Thermobank" refrigeration hot gas defrosting system for ammonia has been developed by **Kramer Trenton Co.,** Trenton, N. J. A time clock and solenoid are used to control the defrosting. To prevent the condensed hot gas leaving the evaporator from returning directly to the compressor, a re-evaporator is placed in the suction line. The re-evaporator is an air-to-refrigerant heat exchanger operating only during the defrost cycle. The three sizes of evaporators have an approximate capacity, at 10 deg temperature difference, of 2, 1½, and 1 ton.

# IMPROVE YOUR KNOWLEDGE OF AIR CONDITIONING

SEND TODAY FOR
Samuel R. Lewis'

## "AIR CONDITIONING FOR COMFORT"

288 Pages—6¼" x 9¼"—Illustrated—
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Here is a book that presents—in simple, readily understandable form—every kind of information necessary for an accurate and thorough knowledge of air conditioning principles, equipment and practices. Written by S. R. Lewis, a widely-known consulting engineer who has been active in air conditioning work for more than thirty years, it deals with all angles of the air conditioning subject from the practicing engineer's viewpoint. The designing procedures explained in the book are, for example, in every detail the same procedures employed today by the author's own organization.

Featuring this third edition are chapters on phases of the subject not previously treated, including noise control, air conditioning measurements, air conditioning standards, fire protection codes and operating suggestions. Several complete examples of correct design procedure are given, together with forms for recording the design data, the proper filling-in of which are explained step-by-step.

The chapter devoted to Psychrometry presents nineteen different formulas for psychrometric calculations. In illustrating the correct use of these formulas, Mr. Lewis applies both the psychrometric tables and charts in order to render both devices thoroughly understandable.

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Engineers in air conditioning will find the "Air Conditioning for Comfort" invaluable as a reference book, while salesmen, students, and others may rely on it to give them a clear knowledge of fundamentals, and of air conditioning methods and equipment.

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CHAP. 2—Heat and Air
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CHAP. 20—Codes and Operating Suggestions
10" x 16" Psychrometric Chart..... Inside Back Cover


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**A COMPLETE LINE OF DEPENDABLE, ALL WELDED**

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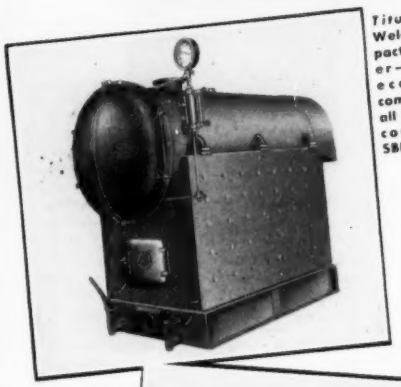
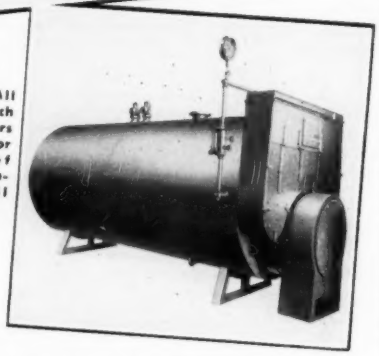
***IN SIZES AND RATINGS TO FIT EVERY REQUIREMENT***



*Titusville All Welded, Compact Steel Boiler—provides economical combustion for all fuels. ASME constructed, SBI rated.*



*Titusville All Welded Scotch Heating Boilers—available for all types of fuel. ASME constructed, SBI rated.*

Since 1860 TITUSVILLE BOILERS have been the accepted standard of quality, dependability and economy. Get the TITUSVILLE facts before purchasing any new or replacement boiler.

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**The TITUSVILLE IRON WORKS Co.**

DIVISION OF STRUTHERS WELLS CORPORATION

TITUSVILLE, PENNSYLVANIA


"Superspun" cast iron soil pipe is centrifugally cast in spinning sand molds by **Combustion Engineering-Superheater, Inc.**, 200 Madison Ave., New York 16. This new method of casting soil pipe is said to provide uniform diameter and thickness, as well as uniform grain structure of metal so that the pipe can be cut with a pipe cutter much in the same manner as steel pipe.

A new improved arc welding electrode, the W-22 (AWS Class E-6010) is available from the apparatus department of **General Electric Co.**, Schenectady 5, N. Y. It is a reverse polarity d-c rod designed specifically for overhead welding of all types of joints in mild steel. High tensile strength and ductility with good impact resistance are said to be features of the rod which is recommended for the repair welding of castings and for welding galvanized plate stock.

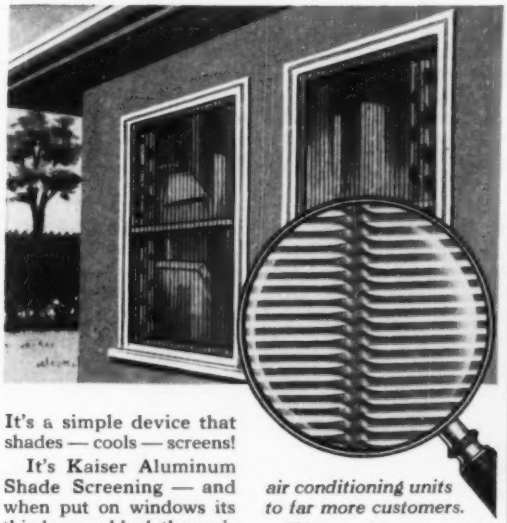
Available from **Mine Safety Appliances Co.**, 201 N. Braddock Ave., Pittsburgh 8, a new protective device is designed to enable welders to work conveniently and safely in atmospheres containing toxic vapors, dusts, and fumes. The facepiece assembly consists of a rubber mask and hood with flexible breathing tube connections. Three lenses are used; one permanent safety lens and removable welding and pitting lenses. The facepiece is adaptable to three different types of masks; combination fresh air hose, air line respirator, and all-service canister. The latter two are for use only outside of tanks. Designed primarily for use in connection with the storage and handling of leaded gasoline, other applications are said to include the repair of large exhaust lines carrying carbon monoxide, the repair of refrigeration systems, and the maintenance of pressure vessels in which the heat of welding might liberate toxic vapors.

The operation of the "Weather-Man" outdoor temperature regulator is graphically demonstrated by means of a new pocket size dummy, prepared by the manufacturer, **Automatic Devices Co.**, Chicago. The demonstrator shows how the control operates the heating system of a typical building under varying outdoor temperature conditions. ..... Unit alarm meter type MC-100 is offered by the recently organized **Unit Alarm Co.**, P. O. Box 727, Elizabethton, Tenn. Designed for flush panel mounting, the meter gives a visual and audible alarm in case of a trouble signal from a remote location. The device may be connected to a pressure, liquid level, or temperature switch to safeguard boiler pressure, liquid level, duct and furnace temperatures, room temperatures, condenser water temperatures, refrigerant pressures, etc.

**Maid-O'-Mist, Inc.**, 3217 N. Pulaski Rd., Chicago 41, has announced a new counter display "merchandiser" for packaging its No. 72 "Auto-Vent" air eliminator. The carton contains a dozen individually boxed valves designed for fast venting of hot water radiators, convectors, and baseboard units.

Available in 2, 2½, 3, 3½, and 4 in. sizes, a new tubular boiler flue cleaning brush is offered by **Kent Co., Inc.**, 435 Canal St., Rome, N. Y. It has been developed for use in conjunction with the firm's "double suction" furnace and boiler cleaner.

# Here's a new boost for air conditioning sales!



It's a simple device that shades — cools — screens!

It's Kaiser Aluminum Shade Screening — and when put on windows its thin louvers block the sun's rays, but not the view. It actually does the work of Venetian blinds *plus* awnings *plus* insect screening — at one-tenth the cost of all three!

*It helps you sell smaller air conditioning units to far more customers.*

Thus, almost every home, office or industrial building becomes a prospect for air conditioning equipment — when you combine the sale with Kaiser Aluminum Shade Screening.

**TYPICAL EXAMPLE OF HEAT REDUCTION WITH KAISER ALUMINUM SHADE SCREENING**

**Industrial application:**

Figuring 23 west windows 3½'x6'. Total area 3½'x6'x23 = 463 sq. ft. taking a 3:00 P.M. peak load, during midsummer at 40° Latitude.

| | B. T. Us. |
|---|---|
| Sun load passing through unshaded windows | 82,200 |
| Sun load passing through Shade Screen | 8,220 |
| Reduced by | 73,980 |

Refrigeration savings = 6.15 tons

**Comparable heat reductions can be made in residential buildings.**

The best sales months are right ahead! So leap on the air-conditioning band wagon now. Write, wire or phone us for a free AIA file and name of your nearest Kaiser Aluminum Shade Screening jobber or contractor.

Kaiser Aluminum Shade Screening is produced by Kaiser Aluminum & Chemical Corporation.

# Kaiser Aluminum

## SHADE SCREENING

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# RAM COSTS DOWN with Ramset Fastening System

Quicker than lightning, the self-contained RAMSET TOOL instantly sets drive pins or threaded studs through steel or wood, into steel, concrete, masonry, other hard materials. Slashes costs and time up to 80% for such fastening jobs. Takes less than a minute from start to finish.

1. **No drilling, chipping, plugging, tapping.**
2. **Insert RAMSET FASTENER into tool, with power charge.**
3. **Place against work spot. Then RAM! The fastener sets, instantly, tightly.**
4. **No make-ready or clean-up work. No muss, no fuss, no dirt.**
5. **Light, compact RAMSET TOOL needs no external power. It's completely self-contained.**
6. **Nothing heavy to haul. RAMSET TOOL can be carried in one hand and used in tight, confined spaces.**
7. **Small first cost, pays for itself quickly—and it's savings and profit from then on!**

A 15-minute demonstration will prove the cost-reducing, time-saving values of RAMSET SYSTEM ... the pioneer in powder-actuated fastening methods. Call your local RAMSET Specialist or use coupon for complete details.

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**ASK FOR DEMONSTRATION AND DETAILS!**

Stemco Corporation, 12117 Berea Road, Cleveland 11, Ohio

Please send further information on cost-cutting, time-saving value of RAMSET FASTENING SYSTEM.

Name _____ Title _____

Company _____

Kind of business _____

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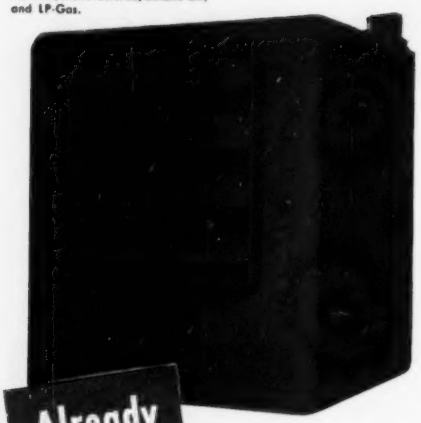
HP

Type 150 Suspended Unit Heater 60,000, 90,000, 120,000, and 150,000 Btu input capacities; for Natural, Manufactured, Butane-air, and LP-Gas.



Already a strong favorite

**Mueller Climatrol Gas-fired Suspended Unit Heater**

***. . . to meet a huge demand and bring extra sales to you***

There is a constant demand for an attractive, compact, efficient, direct-fired gas unit heater — for use in stores, shops, theaters, garages, etc. And the new Mueller Climatrol meets that demand. Its special features give you an advantage over competition that will bring an extra volume of profitable sales to you. Here they are:

**All-welded steel heat exchanger:** Horizontal tubular design with high crown sheet; no impingement of flame. Completely cleanable from top or bottom without lowering unit.

**Compact design — extra head room:** Only 31" high, including diverter and flue vent, on 60,000 and 90,000 Btu sizes. Larger sizes are only 35½" high. Horizontal flue outlet on diverter.

**Aerated flame burner:** Cast iron with drilled ports. Single-opening shutter prevents clogging. Burner size increases proportionately with size of heat exchanger for uniform heat distribution.

**Quiet, high-delivery blower:** Discharge may be directed to suit installation by repositioning the adjustable louvers to blow horizontally or vertically.

This addition to the Mueller Climatrol gas-fired line is shipped complete, pre-wired, ready for quick, easy installation.

It's a new sales-maker for you. Get behind it and you're sure to increase your sales volume and profits. Write for details. *L. J. Mueller Furnace Co., 2126 W. Oklahoma Ave., Milwaukee 7, Wisconsin.* E-37

MUELLER Climatrol
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# WHO'S WHAT

**Jenkins Bros.**, New York City, has elected **Edward R. McPherson, Jr.**, to its board of directors. He is a member of the Cummings and Lockwood law firm of Stamford, Conn. ..... **Harry G. Smith** is now vice president and director of sales for **Ohio Injector Co.**, Wadsworth, Ohio. He comes to the firm from A. O. Smith Corp. where he was manager of the meter division. ..... **Lorin G. Miller**, dean of the college of engineering, Michigan State College, has been named engineering consultant by **United States Radiator Corp.**, Detroit. In his new connection he will actively participate in research and development of company products.

**J. Howard Smart**, sales manager, Tuttle & Bailey, Inc., is the new president of the **Convector Manufacturers Association.** He succeeds **E. A. Cline**, of The Trane Co., who has served for the past two years. **Walter Schlichting**, sales manager of Young Radiator Co., has been elected secretary of the association. ..... **Colby M. Chester**, a director of **Manning, Maxwell & Moore, Inc.**, Bridgeport, Conn., for 20 years, has succeeded the late **C. A. Moore** as chairman of the board. **William J. Jarrett**, vice president and controller, has retired from active service and is succeeded by **John A. Flynn.**

At the recent annual meeting of the **Industrial Unit Heater Association**, the following officers were elected for the ensuing year: president—**J. C. Patterson**, director of sales, industrial heating, Carrier Corp.; vice president—**H. S. Wheller**, president, L. J. Wing Mfg. Co.; secretary-treasurer—**L. O. Monroe.** ..... **Edward F. Ford** is now manager of marketing and promotion, also divisional sales manager, for **C. A. Dunham Co.**, Chicago. For the past two years he has been assistant sales manager. He is assisted by **E. W. Cardiff.**

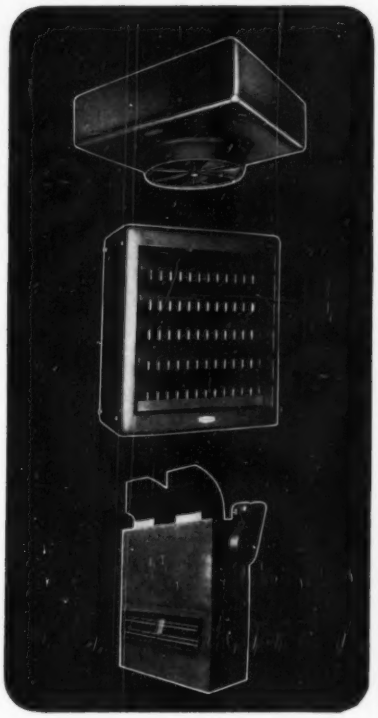
**Powers Regulator Co.**, Chicago, has named **Joseph W. Powers** as general sales manager. He is also vice president in charge of the central division and has served the company in a sales capacity for over 20 years. ..... **Henry F. Hebley**, director of research for Pittsburgh Coal Co. since 1939, has been appointed research consultant to **Pittsburgh Consolidation Coal Co.** In his new post he will coordinate the company's activities in the control of air and stream pollution and will cooperate with both government and civic authorities. Mr. Hebley also serves as the representative of the **Western Pennsylvania Coal Operators Association** in projects involving pollution control.

**Frank R. Freyler** has been promoted to manager of the Mid-Atlantic region of **Allis-Chalmers Mfg. Co.**, Milwaukee. He has been Philadelphia district manager and now succeeds **William Arthur**, who has requested retirement. **Arthur D. Brown**, manager of the Washington, D.C., office, has taken over the Philadelphia post and **R. N. Landreth**, who has been in the Washington office since 1934, succeeds Mr. Brown. ..... **Albert J. Nesbitt**, president of **John J. Nesbitt, Inc.**, was recently elected president of the YMCA of Philadelphia and vicinity. He has long been active in civic affairs and has maintained YMCA affiliations for many years.

# AIRTHERM

## Steam Unit Heaters

**Save Fuel . . .**
**Provide Outstanding**
**Heating Performance**



Vertical Delivery Type

Horizontal Delivery Type

Centrifugal Fan Type, for Floor or Suspended Mounting

There's an Airtherm Steam Unit Heater designed to meet every space heating need.

Airtherm offers you Horizontal and Vertical propeller fan types for all commercial and industrial installations plus the Centrifugal fan type for handling large air volume, long heat throw and ductwork resistance.

The long life coils in Airtherm Unit Heaters have copper tubes and copper headers, brazed into an integral heat transfer unit. For complete heating satisfaction try Airtherm on your next job.

*Write for Bulletins No. 1208 and 401.*

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## *thousands of buildings and homes*

NO. 700A

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The 6 ear attachment of each V shaped louver in our door, partition and duct concealment grilles gives them permanent alignment and a rattle free construction. Furthermore, our matching flanges that telescope make installations easy and will give you an attractive grille that needs no molding. These grilles are available with either aluminum, or, steel cores, ½" or ½" centers and channel or flange frames.

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**DRILL IT!** with a B & D HOLGUN. Drills holes to ¼" diameter in steel to ½" in hardwood.

**DRIVE IT!** with a B & D SCRUGUN. Drives machine screws and nuts to ¼", self-tapping screws to #12, wood screws to #10 x 2". Positive or adjustable clutch available.

**B & D HOLGUNS,* SCRUGUNS* give you MORE WORK**

**Per MAN** These Tools are perfectly balanced, weight saving, compact, with famous "Pistol Grip and Trigger Switch". Accurate and easy to handle. Help your men produce more, with less fatigue and less work spoilage.

**Per HOUR** Abundantly powered by B&D universal motors, they have full power and speed for continuous use—help you do more sheet metal assembly per hour, *every* hour!

**Per TOOL** These Tools give you *extra* years of service! Extra-tough gears, shaft and chuck spindle, powerful motors, husky housings are *built to last!*

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**PORTABLE ELECTRIC TOOLS**

ELECTRIC SHEARS | ELECTRIC SANDERS | BENCH GRINDERS | "WHIRLWIND"® WIRE BRUSHES

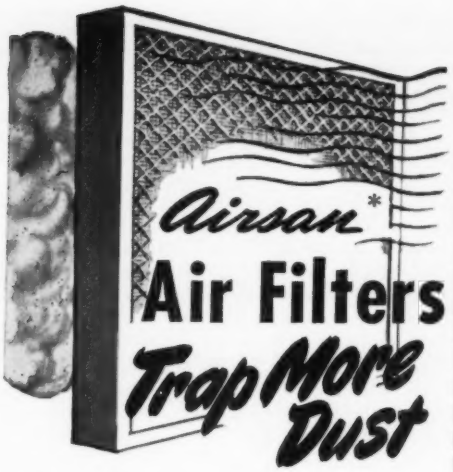

**W. B. Holton, Jr.,** president of Walworth Co., has been re-elected president of the **Valve Manufacturers Association.** Others serving with him are: vice presidents—**Ernest Cochran,** vice president, Chapman Valve Mfg. Co.; **Charles W. Burrage,** secretary, Lunkenheimer Co.; and **Wayne Young,** president, Ohio Injector Co.;—secretary-treasurer—**George A. Cooper.** ..... **Samuel G. Allen,** vice chairman of the board of directors of **Combustion Engineering-Superheater, Inc.,** New York, has been elected chairman of the board to succeed the late **Frederic A. Schaff. Joseph V. Santry,** president of the firm, is also serving as chief executive officer in general charge of operations.

**Walter S. Browning,** assistant sales manager for the last two years, is now sales manager of **C. A. Dunham Co.,** Chicago. He has been engaged in sales promotional work for more than 15 years. Among his duties will be close liaison between company headquarters, jobbers and sales engineers. ..... **K. R. Knoblauch** is now managing sales of valve products for the industrial division of **Minneapolis-Honeywell Regulator Co.** He joined the Brown Instruments division of the firm in 1924, was made assistant sales manager of the industrial division in 1939, and four years later was placed in charge of market extension and sales promotion.

**H. F. Lefferty** has been with **Babcock & Wilcox Tube Co.,** Beaver Falls, Pa., for over 33 years, most recently in charge of the Chicago district sales office. He is now Pacific coast sales manager and has succeeded **H. P. Curtis** who resigned to enter other activities. ..... **B. G. Krause,** manager, Air Controls, Inc., has been elected president of the **Propeller Fan Manufacturers Association. W. H. Holt,** manager, fan merchandising and standard apparatus division, Buffalo Forge Co., is vice president, and **L. O. Monroe,** of Detroit, is secretary-treasurer.

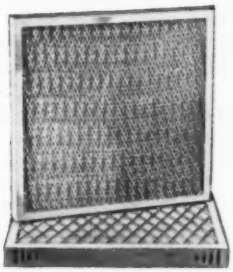
**Fedders-Quigan Corp.,** Buffalo, has named **Robert E. Cassatt** advertising manager. He had been assistant advertising and sales promotion manager of the General Electric Co. receiver division. ..... **Wolverine Tube Div., Calumet & Hecla Consolidated Copper Co., Inc.,** Detroit, has established a new sales office in the Eighty-One Madison Bldg., Memphis. **M. J. Cook,** formerly company representative in Jackson, Miss., is in charge. With headquarters in Philadelphia and covering Delaware and eastern Pennsylvania, **Arthur W. Retzel** has been appointed a company representative. He was formerly a sales engineer for Eastwood Neally Corp. and a representative for Scovill Mfg. Co.

**Lewis R. Smith** is now product development engineer for **Remington Air Conditioning Div., Remington Corp.,** Cortland, N. Y. After serving with Westinghouse Electric Corp. for 10 years, he was chief engineer of Acme Industries, Inc., and subsequently was chief engineer of the refrigeration division of Savage Arms. More recently, he has been engaged as a consulting engineer. ..... **Willis W. Mansfield** has succeeded the late **Mark D. Disosway** as factory manager of **Penn Electric Switch Co.,** Goshen, Ind. He has been with the company for 15 years and had been acting factory manager.



# Airsan* Air Filters Trap More Dust

## For Air Conditioning, Heating and Ventilating



Greater efficiency — lower resistance is yours with an AIRSAN Air Filter.

A permanent, cleanable viscous type filter of all galvanized construction, having full bronze welded corners. Expanded metal face plate acts as lint arrestor to provide easier cleaning and servicing. Rated filtering efficiency 98.5%. In standard 1" and 2" thickness.

Also available for heavy duty service on industrial and special applications — in 2" to 4" thickness. Holding frames (for V-type or straight banks) are made for all type filters.

SEND FOR BULLETINS →

* FORMERLY AIRCOR

**Air Filter Corporation**

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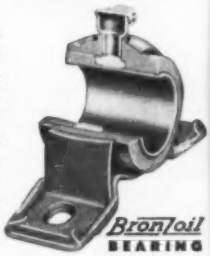
Canadian Representative: DOUGLAS ENGINEERING CO., Ltd. Montreal

A Few Distributorships Available . . . Write for Details.

Airsan

## IN A MILLION INSTALLATIONS!

This is the Dodge Bronzoil Bearing—one of the most remarkable items available to fan and blower manufacturers. Engineered especially for fan and blower service. Refined over the years to meet the *many* exacting needs of such service. It is THE bearing to tie to for product dependability, *as proved in a million installations.* WRITE for literature and details.




- Ideally suited to domestic units. Shaft sizes from 3/4" to 1¼".
- Self-oiling composition bushing feeds oil to shaft by capillary action. Bushing shoulder provides self-lubricating bearing surface for collar.
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- Slotted bolt holes. Neoprene, static-proof, oil resistant grommets are available for sound isolation.
- Split pressed steel housing. Strong, yet light.

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of Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. He's factory-trained to help solve your power drive problems. Look for his name under "Power Transmission Machinery" in your classified telephone directory.

HOW TO SAVE UP TO
$5,000
ON AIR CONDITIONING

PAT. NO. 2,297,928

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COMPLETELY PACKAGED
AIR CONDITIONER

Save water! Save space! Save installation time and money! Save operating costs! Yes, install Governair and *save from $50 to $200 for each ton* of the completely packaged Governair unit designed to fit your needs!

Experience proves Governair can save you up to $5,000 on a 50-ton Governair unit that gives greater dependability and more "engineered efficiency" than ever before!

If you want the best — if you want the most economical and reliable air-conditioning unit on the market . . . CHOOSE GOVERNAIR and SAVE!

AIR CONDITIONERS

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BLAST COILS FOR HEATING & COOLING

ORIGINATORS OF COMPLETELY PACKAGED AIR CONDITIONERS

GOVERNAIR

UNIT COOLERS

GOVERNAIR CORPORATION • 513 N. BLACKWELDER • OKLA. CITY

**M. Russell Kambach** joined the advertising department of **Aluminum Co. of America,** Pittsburgh, in 1930. He has been assistant advertising manager for the last year and was recently named manager. He is succeeded as assistant by **Jay M. Sharp** of the advertising department. ..... **Pelton W. Ellis** is now managing the refining equipment division of **Peabody Engineering Corp.,** New York. Previous to his association with the firm he was a sales engineer in the petroleum industry in South America. ..... The new manager of the burner division, **Enterprise Engine & Foundry Co.,** San Francisco, is **V. M. Douglas.** Since joining the company a year ago, he has served in the engineering and experimental departments, as well as in field service activities.

**Carl E. Buchholzer** and **W. E. Mack** have been appointed to the staff of W. C. Newberg, president, **Airtemp Div., Chrysler Corp.,** Dayton, Ohio. Mr. Buchholzer, who has been service manager of the division, has been named assistant to the president. Mr. Mack, who has been superintendent of planning, will handle special assignments. ..... **O. J. Prentice,** for many years director of publicity and public relations for C. A. Dunham Co., is now an advertising and public relations counsellor. He is located at 601 Diversey Parkway, Chicago. ..... **James W. Elizardi** has recently been made manager of the Houston, Tex., sales office of **Marley Co., Inc.,** Kansas City, Kans. He was previously with Griscom-Russell Co. and the Illinois Central Railroad.

**York Corp.,** York, Pa., has appointed four new distributors. They are: **Calcasieu Lumber Co.,** 201 W. 2nd St., Austin, Tex.; **Clayton C. Smith Co.,** 702 Mulberry St., Williamsport, Pa.; **Hawes Electric Co.,** 333 Washington Ave., Huntington, W. Va.; and **Modernized Equipment Co.,** 922 Race St., Cincinnati. These distributors will handle air conditioning equipment up to and including 30 hp and refrigeration installations of 10 hp and smaller.

**Reliance Electric and Engineering Co.,** Cleveland, has recently appointed six sales application engineers to district offices. The men and their assignments are: **Keith E. Carter,** Pittsburgh; **Thomas R. Corn,** Cleveland; **Ralph I. Coryell,** Syracuse; **Warner Jennings,** Detroit; **William C. Mitchell,** Philadelphia; and **H. Norris Robinson,** New York. **Robert O. Gee** has been assigned to the applied engineering department at the home office.

Two new division sales offices have been established by **Wagner Electric Corp.,** St. Louis. The New Orleans office, a sub-branch of St. Louis sales under the direction of **N. G. Alvis,** is located at 227 International Trade Mart. The Davenport, Iowa, office, located in the Kahl Bldg., is under the direction of **S. R. Snyder** and is a sub-branch of Chicago. **G. W. Morris,** of the Omaha office, has retired and is succeeded by **G. D. Jackson.**

With offices at 1303 Stanford Ave., Emeryville, Calif., **C. L. Stocker** has assumed sales and engineering responsibilities in the San Francisco area for **Lincoln Electric Co.,** Cleveland. He is succeeded as district manager in the Seattle area by **A. L. Patnik,** located at 1914 Utah Ave., Seattle. **M. F. Yale** and **T. Nichol** have been appointed to the Emeryville office. ..... As field

# Jaden Newly Designed AIR CONDITIONERS

- INEXPENSIVE TO BUY. Simple water-cooled design reduces the cost.
- SIMPLE TO INSTALL. Comes completely assembled. Merely connect to water line and electric line—you're ready to go!
- INEXPENSIVE TO OPERATE. Operates on regular 60° (or colder) water supply.

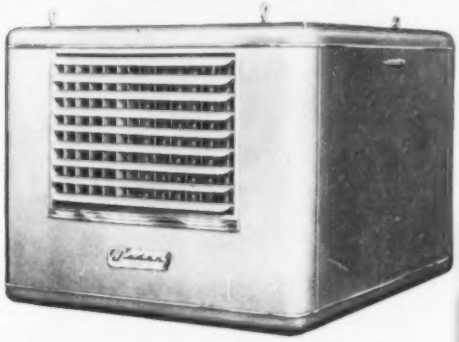
MODEL F-1. 1 to 2 ton capacity. Floor model.
Single-room unit. 120 sq. ft. of counter-flow water-chilled fins. Quiet centrifugal blower. Filter. Adjustable Louvers. 1/16 H.P. motor ½" pipe thread water connections. Beautiful cabinet—oven-baked "hammer-tone" enamel. Shipping Wt. 240 lbs.

- CHOICE OF MODELS AND SIZES. Suspension and floor units. For private office, living room, hospital room, barber shop, beauty parlor — up to cafes, stores, banks, shops, etc.

- ALL-YEAR USE. Cold water COOLS in summer. Hot water HEATS in winter.

**WRITE**

Send for complete new literature illustrating and describing the various models of the sensational water-cooled Jaden Air Conditioners.



MODEL C-2. 1½ to 3-ton capacity. Suspended model.
215 sq. ft. of counter-flow water-chilled fins. Combs heat and humidity out of sultry summer air. Centrifugal blower operates quietly. Easily replaced filters. Louvers. ¼ HP 110-volt motor. ½" pipe thread water connections. Removable panels for easy access. Beautiful oven-baked "hammer-tone" enamel finish. Shipping Wt. 284 lbs.

**JADEN MFG. COMPANY ..... Hastings, Nebr.**

Johnson Oil Burners

**SINCE 1903....**

## ONE OF THE GREAT NAMES IN THE OIL BURNER INDUSTRY!

You can install Johnson Burners with confidence that they will really save oil, and that their operating and maintenance costs will be low. Every burner we produce has been engineered to give that kind of service.

We've been building oil burners for 47 years. From the first, we have aimed at producing *more heat* from *less oil*. All our accumulated experience, all our engineering skill has been concentrated on that goal.

It's little wonder that the long-term performance of our burners is hard to equal . . . and that heating experts, the world over, have come to think of "Johnson Oil Burners" as one of the great names in the industry.

You'll find it's a good name to remember when you want heating equipment on which you may safely depend. There's a Johnson Burner for every need. We will gladly cooperate with detailed information.

**...AND SOME FAMOUS JOHNSON TRADEMARKS**

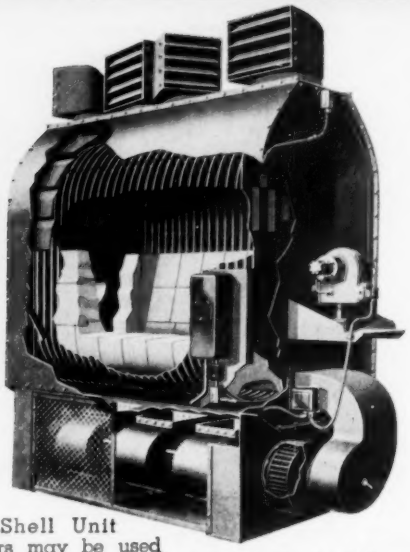
*Bankheat* Burners
*Agulux* Water Heaters
*Econolux* Heat & Hot Water Units
*Selectair* Air Conditioners
*Aerolux* Direct Fired Oil Furnaces
*30 AV and AVH* Heavy Duty Burners

**S. T. JOHNSON COMPANY**

Johnson Oil Burners

940 Arlington Avenue, Oakland 8, Calif.
401 No. Broad Street, Philadelphia 8, Pa.

LEE SHELL UNIT HEATER



Lee Shell Unit Heaters may be used singly or as a central system with the heated air distributed through ducts.
The efficiency of Lee Counter-current flow reduces fuel consumption while the rugged simplicity of the system decreases cost of installation, assures low maintenance charges and provides ventilation without additional cost.

The LEE line . . .
Steel Encased Tubular Heater
Tubular Unit Heater
Brick-Set Tubular Heater
Shell Unit Heater
Write now for more information

LEE ENGINEERING CO.
95 RIVER ST. HOBOKEN, N. J.

training director of the **Institute of Boiler and Radiator Manufacturers, Arthur L. Wales** will supervise and conduct schools covering the installation of hot water and steam heating systems. He has been a division head of the New England Technical Institute.

The ventilator division of **Swartwout Co.**, Cleveland, now shares the firm's New York City branch office at 103 Park Ave. with the steam specialties division. **Frederick Rickmeyer** has been placed in charge, filling the vacancy created by the death of **Percy Jones.** He is assisted by **Eugene Rogers.** Mr. Rickmeyer had been with the New York engineering firm of M. W. Kellogg Co. ..... **Gray Equipment Sales Co.**, 3219 Cheltenham Rd., Toledo, and **Air Purification Co.**, 1863 Wazee St., Denver, are newly appointed representatives of **New York Blower Co.**, Chicago.

**Bryant Heater Div., Affiliated Gas Equipment, Inc.**, Cleveland, has transferred **Alfred C. Johns** to the Dallas branch office in the capacity of a sales engineer. He has been in the home office sales engineering department for the last three and one half years. ..... **General Controls Co.**, Glendale, Calif., has opened a branch office with warehouse facilities at 721 S. Orange Ave., Newark, N. J. **William Buck,** formerly sales engineer in the Philadelphia branch, is in charge. Other recent personnel changes include the appointment of **R. M. Korty** as branch manager in St. Louis, the addition of **Robert L. Day** to the sales engineering staff in San Francisco, and the appointment of **Rudolph J. Roedder** as a refrigeration specialist in the Los Angeles office.

**H. H. Falkingham** has been promoted from district representative to eastern area field sales manager for **Williams Oil-O-Matic Div., Eureka Williams Corp.**, Bloomington, Ill. **R. F. Becker,** district representative in central Illinois, has taken over Mr. Falkingham's old territory consisting of Kentucky, Tennessee, and southern Indiana. ..... **Harry Cooling Towers, Inc.**, Doylestown, Pa., has opened an office for sales, engineering, and service operations at 125 Cedar St., New York City. **Morton H. Staub,** who has been connected with the sales organization of Phillips Cooling Tower Co., Inc., is in charge of the new office and has also been named vice president in charge of sales.

**Edmund D. Haigler** has joined **Fischer & Porter Co.**, Hatboro, Pa., to work on special customer engineering problems. He has over 20 years' experience in industrial instrumentation and was formerly manager of the engineering department of Foxboro Co. ..... **Flexitallic Gasket Co.**, Camden, N. J., has appointed three new agents and two new distributors. The sales agents are: **Boiler Equipment Service Co.**, Atlanta, covering Alabama, Florida, Georgia, North and South Carolina, and Tennessee; **Lane Machinery Co., Inc.**, St. Louis, handling eastern Missouri, southern Illinois, western Kentucky, western Tennessee, and northeastern Arkansas; and **Plant Equipment Co.**, Minneapolis, for Minnesota, North and South Dakota, western Wisconsin, and northwestern Michigan. **Moorlane Co.**, Tulsa, with branches in Kansas City, Amarillo, Denver, Oklahoma City, and Wichita, is a new distributor, as is **Consultores Y Abastecedores Industriales**, Mexico City.

for • SPRAYING
• WASHING
• RINSING
• COOLING
• AIR CONDITIONING

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FAN-TYPE FOR FLAT SLICING SPRAY

Get the most out of your Spraying Equipment with minimum power . . . with efficient spraying.

Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute-type producing a fine hollow spray with minimum energy loss, and Yarway Fan-type producing a flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

**Thousands in use. Write for Bulletin N-616.**

**YARNALL-WARING COMPANY**
**107 Mermaid Avenue** **Philadelphia 18, Pa.**

Patterson "copper-lined" hot water storage heaters supply well known activities in metropolitan *Boston*

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DEACONESS HOSPITAL

In one of the above installations—Belmont High School—the Patterson Copper-Lined Storage Heater has been in service for well over 20 years. In fact, in and around Boston there are many Patterson Copper-Lined Heaters still going strong although installed from 20 to 40 years ago . . . a record which indicates that copper-lined heaters are *durable* as well as non rusting and that Patterson-Kelley personnel has the experience and skill with which to properly make copper-lined heaters.

We suggest you consider "copper-lined" for the next "water storage heater" jobs you have coming up.

*the* Patterson-Kelley Co., Inc.

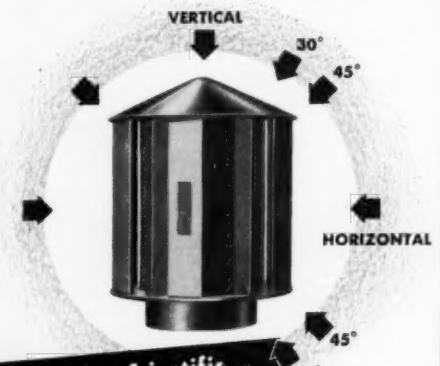
90 Burson Street • East Stroudsburg, Pa.

*offices or representatives in principal cities*

# CAUTION

## to Ventilator Buyers

**If you want to *be sure* of what you're getting when you buy ventilators, insist on *certified* capacity ratings based on tests made with wind blowing in *all* directions, as indicated below.**




**The First Scientific Improvement in Ventilators in over 50 Years!**

Breidert Air-X-Hauster Type B

***Only such tests can guarantee the capacities a ventilator will deliver under actual operating conditions!*** **Don't be misled into buying on size alone. Insist on the correct size for the capacity required.**

The Breidert Air-X-Hauster has been tested by Smith, Emery & Co. of San Francisco, Pacific Coast branch of the Pittsburgh Testing Laboratory, with wind directed at *all* angles shown above. It is the *only* ventilator on the market with published certified ratings based on such tests. Breiderts are extensively used on industrial, commercial and residential buildings all over the country, and on most types of pleasure craft and ships.

For detailed information and free Engineering Data Book on the Breidert, send the coupon.

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# NEW BOOKS & REPORTS

### Pennsylvania Reports on Donora Smog Disaster

The smog episode in Donora, Pa., and vicinity occurred October 27-31, 1948. The Pennsylvania Bureau of Industrial Hygiene, in cooperation with the Industrial Hygiene Foundation of the Mellon Institute collected sulfur dioxide samples from the Donora atmosphere the morning and afternoon of October 31, 1948. The Bureau of Industrial Hygiene continued atmospheric sampling in the valley and 223 samples were collected in the area under varying weather conditions before the United States Public Health Service began the engineering phase of its formal investigation.

The Pennsylvania Bureau of Industrial Hygiene report, The Donora Smog Disaster, was prepared by Joseph Shilen, M.D., director, Joseph F. Mellor, Jr., assistant director, J. S. Harrah, industrial hygienist, and C. D. Robson, assistant industrial hygienist. The data and conclusions of this report are in many ways similar to the Public Health Service preliminary report, Bulletin No. 306 (see page 88, February HPAC for a review of the government report).

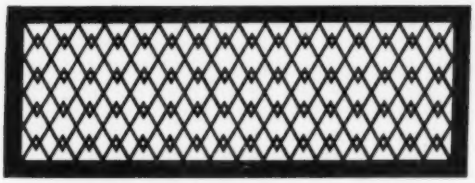
The maximum concentration of sulfur dioxide on October 31 was found to be 0.54 ppm. It is pointed out, however, that the concentration decreased during the day so that readings taken in no way indicated the concentrations that might have existed the previous Friday night—the time of onset of illnesses. In subsequent samples, the highest concentration of sulfur dioxide was found to be 0.75 ppm but the average concentration was 0.17 ppm.

The authors conclude that since meteorological conditions were changing at the time the first sulfur dioxide samples were taken, it is believed that higher concentrations existed on October 29 and 30. The overall annual mortality rate for Donora residents was not significantly different for 1948 when compared with the Donora rate for 1947. A spot check of the dental health of children did not indicate mottling of the dental enamel from reported fluoride exposures. An x-ray survey did not indicate any evidence of chronic pneumonitis. In addition to atmospheric pollution, the weather and topography were contributing factors, according to the report.

### Summarizes Information on the Heat Pump

Heat Pump Applications, by Emory N. Kemler, associate director, Southwest Research Institute, and Sabert Oglesby, Jr., instructor in electrical engineering, Purdue University, presents a summary of the many contributions to the advancement of the heat pump and consolidates much of the information available in the literature on this subject. Also included is material which has been developed by the authors and some of the groups with whom they have been associated. Mr. Kemler is the author or co-author of seven articles which have appeared in previous issues of HPAC.

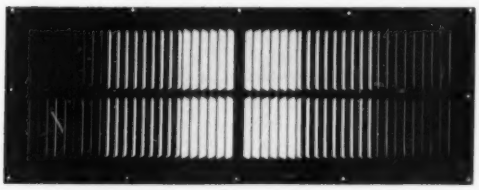
After introducing the subject by means of a brief description of heat pump operation, coefficient of performance, and future potentialities, the authors present, in three chapters, descriptions and tabulated performance data on commercial, industrial and residential installa-



A Hendrick grille design (M No. 9) suitable for use with deflecting unit in Bulator combination.

# The Perfect Combination

## of a deflecting unit and ornamental grille



Vertical deflecting vanes, showing how the vanes may be set to produce any desired air stream pattern.

Now you can secure all the advantages of an adjustable deflecting vane grille—*to control air flow*—and an ornamental grille—*to harmonize with the decorative scheme*—by specifying the new dual-unit Hendrick BULATOR.

For this combination of deflecting unit and ornamental grille there's a wide selection of Hendrick ornamental grille designs which have ample open area so the air throw and spread are not appreciably affected.

Mounted just behind the ornamental grille, the deflecting unit is not noticeable, and its vanes are adjustable so that the air flow can be deflected to right or left, up or down, or in a combination of directions.

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SEE YOUR NEAREST DEALER IN SWEET'S

Perforated Metals
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*Manufacturing Company*
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*Sales Offices in Principal Cities*

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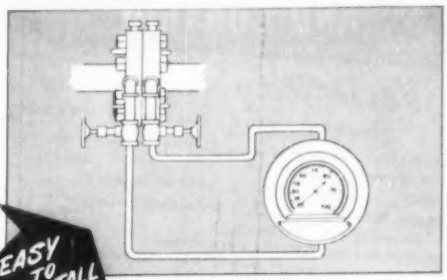
There's no gauge like FLO-GAGE for simplicity, economy, and all-around usefulness. Now, this compact rate of flow indicator packs another big feature: *positive, automatic protection against overloads and reverse differentials!*

Other features of the Builders FLO-GAGE: Accurate — easy to read — low cost — requires no mercury or auxiliary power supply — no stuffing box — negligible maintenance — simple design — durable construction — ideal for water, steam, air or gas lines. For information and descriptive Bulletin, address Builders-Providence, Inc. (Division of Builders Iron Foundry), Providence 1, R. I.



EASY TO INSTALL with orifices or other differential producers.

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Flow meters and controllers . . . mechanical and differential . . . for liquids, steam, air, and dry materials. The Venturi Meter • Chlorinizers-Chlorine Gas Feeders

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tion in this country and in Europe. A chapter on thermodynamics of refrigerants and cycles is followed by one covering heat pump cycles. Considerable space is given to the important subject of heat sources and data are given on thermal conductivities of various soils. Also presented are steady state equations for heat flow, the use of heat of fusion, and the Kelvin heat source theory.

Other chapters deal with compressors, fans and ducts, motors, heat exchangers, accessories, temperature and design data, and storage and hot water units. A final chapter gives a patent survey.

Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, this 300 page (6 × 9 in.) clothbound text is priced at $6.00.

### Calculates Ground Temperatures Near Buried Pipe Heat Sources

Frank H. Bridgers, instructor in mechanical engineering, Purdue University, has proposed a superposition method whereby the temperature pattern around a single buried heat source at a given temperature is used to arrive at the pattern obtained when several heat sources at the same temperature are placed at any distance apart. In his paper, Combination of Heat Sources and Sinks by the Method of Superposition, presented at the fall meeting of the American Society of Mechanical Engineers, an equation is derived to give the "strength ratio" which is defined as the ratio of heat dissipated by one of a series of buried heat sources of equal temperature to the heat dissipated by a single heat source at the same temperature. This equation is plotted for a specific case to show the "strength ratio" as a function of heat source spacing. Experimental temperature distribution patterns around a heated tube buried in a box of sand are shown for two specific tube arrangements: (1) the tube being the only heat source in the solid, and (2) the tube placed between two other sources at the same temperature.

Although the proposed superposition method is subject to an inherent error, which may be severe at very close spacing of heat sources, the agreement between experimental and calculated results for the cases investigated in this work is said to be good.

Copies of the report, designated as No. 49-F-13, may be obtained from ASME headquarters, 29 W. 39th St., New York 18.

### Heating, Air Conditioning Fundamentals Condensed in Notebook and Workbook

W. T. Miller and Frederick B. Morse, both of Purdue University, have prepared notes on heating, ventilating, and air conditioning primarily as a text to present the practical applications of fundamental principles for a two semester college course.

Although prerequisites include a knowledge of elementary physics and thermodynamics, care has been taken to make the notes sufficiently self contained to avoid seriously handicapping anyone lacking a thorough understanding of these subjects. Throughout, the underlying theory has been restricted to a minimum and the practical application of basic principles has been emphasized. Subjects covered include heat transfer, condensation in structures, physiological factors, heating requirements of buildings, warm air heating, steam and hot water heating, thermodynamic properties of air and

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CEMENT . . . checking drying and setting characteristics.
PAPER . . . controlling humidity to insure proper printing qualities.
PHOTOGRAPHIC FILMS . . . insuring uniform quality by controlling humidity in emulsion-coating rooms.
FOUNDRIES . . . controlling dryness of sand molds to prevent blowholes and accidents.
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NATURAL GAS . . . eliminating costly interruption of service due to excessive moisture in pipelines.
SENSING ELEMENT (Actual Size)
Plus . . .
SENSITIVITY . . . detects humidity changes as small as plus-minus 0.15% relative humidity.
SPEEDY RESPONSE . . . responds instantly to micro changes in relative humidity at temperatures from 40° to 140° F.
ACCURACY . . . measures accurately within plus-minus 1½% relative humidity without periodic attention
COMPACTNESS . . . sensing element occupies a maximum of 2 cubic inches.
RELIABILITY . . . guaranteed for one year—will give many more years of satisfactory service when used properly.
WIDE ADAPTABILITY . . . measures, indicates, records and/or controls relative humidity. Drives air-operated devices. Can be used for remote control. Neither adds nor removes moisture or heat (can be built into sealed electrical components). Measures moisture content of solids, air, and other non-corrosive gases.
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FAMOUS *Syncromatic* COUNTER FLOW

STEEL FORCED WARM-AIR FURNACES
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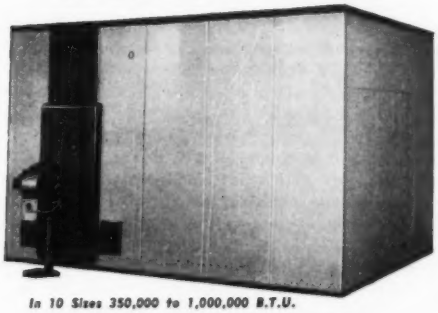

*In 10 Sizes 350,000 to 1,000,000 B.T.U.*

**IF ORDERED KNOCKED-DOWN CAN BE TAKEN THROUGH A THREE FOOT DOORWAY**

*Heat Exchanger*
*OFB 100 — 1,000,000 B.T.U. Output*

*For Full Information Write*

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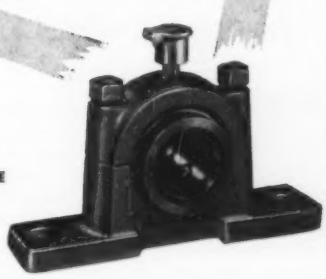
*Randall*
*self-aligning*
*self-lubricating*
**PILLOW BLOCKS**



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You make sure of smooth, quiet operation for the life of your equipment when you specify Randall Pillow Blocks. Only Randalls have self-lubricating, graphited phosphor bronze or sintered bronze bushings in self-aligning, wool-felt-packed oil reservoir housings. You can afford Randall quality since the line is very complete and offers a type and size that is exactly right for the job. Write for Catalog 49 with complete data.

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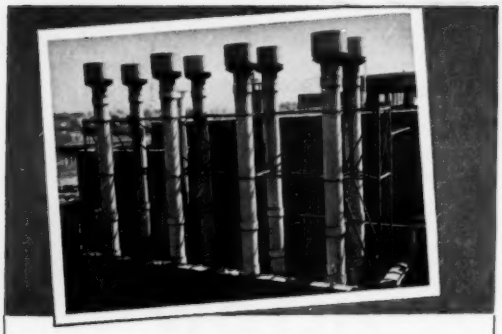

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Workable: Transite can be cut and drilled on the job.

IN INSTALLATIONS in many industries where corrosive fumes, vapors, dusts, and gases are encountered, Transite Industrial Vent Pipe is yearly demonstrating the fact that it is a practical, economical answer to tough venting problems.

Because it is an asbestos-cement product, this strong, durable pipe stands up in many types of corrosive service . . . helps avoid costly replacement . . . results in important reductions in plant maintenance.

**Easily installed**—Transite Industrial Vent Pipe has many practical installation advantages. It is light in weight and easily handled. It is readily worked and can be quickly cut and drilled on the job with ordinary tools.

Adaptable: A complete line of Transite fittings meet most requirements.

**Easily adapted**—Made in a range of sizes up to 36" in diameter, Transite Industrial Vent Pipe is readily adapted to use as vents, ducts, and stacks. A full line of Transite fittings provides a venting system that is corrosion-resistant throughout.

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JM

**Johns-Manville TRANSITE Industrial Vent PIPE**

vapor mixtures, air conditioning for comfort, and duct design.

As stated by the authors, this notebook is by no means complete, but it can serve as a handy reference book, particularly as sketch sheets have been provided for the insertion of additional notes, etc.

This third edition of Heating, Ventilating, and Air Conditioning Notebook is produced by offset printing, contains approximately 330 pages (8½ x 11 in.), is spiral bound, and is available for $3.75 from Tri-State Offset Co., 817 Main St., Cincinnati 2.

### Gives Data on Mineral Wool Applied to Sheet Metal Surfaces

A new 36 page standard, issued by the Department of Commerce, is entitled Mineral Wool Insulation for Heated Industrial Equipment and supersedes Commercial Standard CS117-44.

The standard now covers also the loose, granulated, and felted forms of mineral wool along with the blanket, block, and industrial batt forms on which some data have already been published. Twenty-six line drawings show how to apply wool to both flat and curved surfaces of all types encountered in high temperature installations. New drawings show how to enclose the material between metal sheets and between brick walls, how to support blanket insulation by clip-angles or by impaling it on wires, and how to attach mineral wool with a stud gun, by bolts with heads welded to the metal surface, by sheet metal screws, or by hairpin wires.

Specification data cover density, thermal conductivity, etc. A table lists nine types of mineral wool, including pipe insulation and insulating cement. For each type, the maximum thermal conductivities at 200, 300, and 400 F are given, as well as recommended maximum temperature limits and typical sizes of commercial packaging. A second table gives thicknesses of standard and double standard molded type pipe insulation for insulating standard steel pipe from ½ to 14 in. in diameter.

Recommended minimum installation thicknesses to which the various forms of mineral wool should be applied when insulating equipment up to 1800 F are given in four additional tables. Six line-drawings show cross sections of the insulation and supporting materials as applied to brick, steel, tanks, ducts, and pipes. The use of insulating cement is outlined and illustrated both for indoor and outdoor applications. Seven pages are devoted to the application of blanket type and molded type insulation to pipe and pipe fittings. Included are eight line drawings illustrating application to large and small valves, flanges, and fittings, in single and double layers.

Single copies of the standard may be obtained, at no charge, from the Industrial Mineral Wool Institute, 441 Lexington Ave., New York 17.

### Compiles Standards on Industrial Water

The recently compiled ASTM Standards on Industrial Water bring together in convenient form the various standard methods of sampling, analysis, and testing of industrial water, especially water used in steam generation and for process or cooling purposes.

The publication includes 26 methods which cover sampling, analysis, corrosivity tests, methods of reporting,

*Simplify* **fastening insulation to metal ductwork with LEXSUCO INSULATION CLIPS**

**SIMPLE** — Just insert the clip in the insulation and with the sharp blow of a hammer, it locks itself to the metal duct. The shoulder prevents penetration beyond insulation thickness.

**SPEEDY** — This easy "hammer and nail" method provides very fast application.

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**SIZES** — Available for 1/2", 13/16" and 1" thick insulation.

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DEPT. 106

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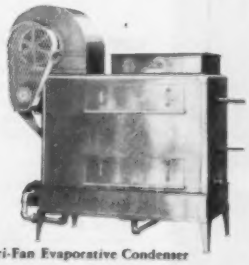
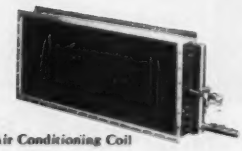
Vertical Air Conditioner



Dri-Fan Evaporative Condenser

Horizontal Air Conditioner



Air Conditioning Coil

Refrigeration ENGINEERING, INC.
7250 East Slauson Avenue Los Angeles 22, California

and general testing methods. A list of ASTM symposiums and technical papers is also included.

Copies of the 142 page, paper covered report can be obtained from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, for $1.75.

### Other Books and Reports Received

**Engineering Papers of Hydraulic Institute,** Vol. 2—Published by the Hydraulic Institute, 90 West St., New York 6 and priced at $2.00. The four papers included are: Cavitation in Centrifugal Pumps, by A. J. Stepanoff, The Centrifugal Pump in the Process Industries, by A. T. Nielsen, Operation of Centrifugal Boiler Feed Pumps, by Hans Gartmann, and Submergence for Centrifugal Condensate Pumps, by Hollis T. Waldo.

**Residual Stresses in Metals,** by Dr. William Marsh Baldwin, Jr., research professor and director, metals research laboratory, Case Institute of Technology—This is the 1949 Edgar Marburg Lecture of the American Society for Testing Materials. It covers the fundamental differences in the mechanisms by which residual stresses are developed by cold working operations, casting, welding, and heat treatment. Also discussed are experimental methods used to evaluate residual stresses. Copies of the 48 page, paper covered booklet are available from ASTM headquarters, 1916 Race St., Philadelphia 3, for $1.00.

**SBI Ratings for Scotch Type Boilers**—Issued recently for the first time in printed form by the Steel Boiler Institute, Land Title Bldg., Broad and Chestnut Sts., Philadelphia 10, this rating code applies to Scotch type boilers designed for working pressures of over 15 psi. The code was adopted in May 1947 and was revised in June 1948. It covers only boilers designed in accordance with the ASME Boiler Construction Code for Power Boilers.

**ASTM Standards on Coal and Coke**—Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, this 164 page, paper covered booklet gives 28 test methods, specifications, and definitions of terms in their latest approved form, together with numerous proposed methods. Test methods and procedures on coal cover sampling, analysis for volatile matter in connection with smoke ordinances, grindability, drop shatter test, tumbler test, screen analysis, sieve analysis, cubic foot weight, index of dustiness, and free swelling. Specifications cover classification of coal by rank and grade. Copies may be obtained from society headquarters for $2.00.

**Welding and Cutting Fumes and Health and the Welder** is the title of a 13 page reprint of three articles published in a welding magazine. Illustrated and containing a bibliography on the subject, it deals with common questions relating to health hazards in welding. Copies are offered for 25 cents by Lincoln Electric Co., Cleveland 1, Ohio.

...Digging for facts

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YOU'LL FIND THESE KLIPFEL BULLETINS PRACTICAL, FACTUAL AND USEFUL!

Klipfel engineers have put a lot of experience and research into these bulletins to make them useful to you . . . the man who uses or specifies automatic regulating valves. Each bulletin covers such points as: the advantages and limitations of different valve constructions; selecting the proper type valve for given operating conditions; determining the most effective and economic size valve for the job.
In short, Klipfel engineers have prepared these bulletins to assist you in selecting the type and size valve best suited to your needs.
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for steam, air and water . . . in lever and weight, air loaded, pilot control and spring loaded types; descriptions, illustrations and complete selection data in Bulltin 148.

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for control of air, steam and water pressures at the valve inlet in various types for practically any service. Bulletin 648 gives complete details including dimensions and capacities.

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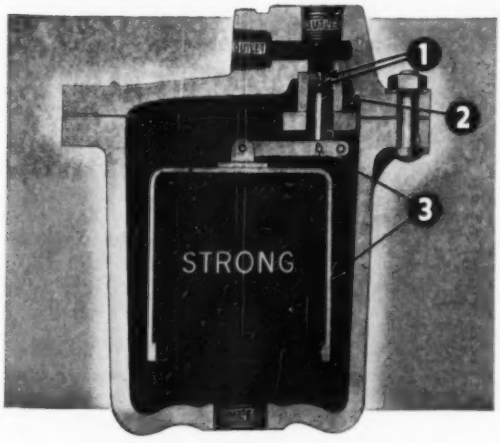
# 3 Reasons STRONG* Traps are easy to maintain!




Look for these three STRONG low-maintenance features in the STRONG 80 Series Inverted Bucket Trap:

1. **Anum-Metl Valve and Seat—guaranteed leakproof for one year;**
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3. **Stainless steel bucket and trim.**

Compare these features with other traps!

STRONG 80 Series Trap sizes ½" to 2½", pressures to 250 lbs., temperature to 500° F. (forged steel for higher pressures).

Dual outlet simplifies piping, bottom inlet keeps trap cleaner. Years of trouble-free operation assured by super-STRONG construction.

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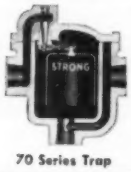

70 Series Trap

Strainer

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## TYPE PVS EXHAUST FANS

### FEATURES

**ALL-PEERLESS ELECTRIC UNITS**—These fans are completely designed and manufactured by The Peerless Electric Company, a manufacturer of fans and motors since 1893. Both the motor and fan are designed to work together as a unit. This assures quiet operation and full rated output.

**CAPACITOR MOTOR**—Permanent split capacitor type using no internal switches or mechanical parts to fail and cause breakdowns. Totally enclosed to exclude all dirt and moisture drawn over the motor. Highest quality material available used on all parts for a trouble-free motor.

**QUIET OPERATION**—Wide heavy gauge steel blades rotating at slow speed to assure rated capacity at low noise level.

**HORIZONTAL OR VERTICAL MOUNTING**—Fans may be mounted in either position. Ball bearing in rear hood to take end thrust in all positions. Easy to lubricate and service.

**FURNISHED COMPLETE**—Controller for single speed, two-speed, or three-speed furnished with unit as ordered. No other switches or starting equipment required.

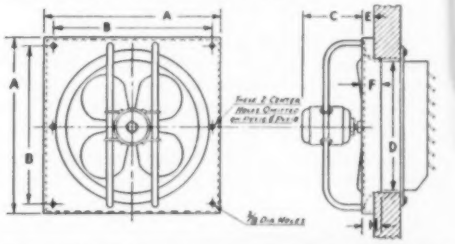
**EASY TO INSTALL**—Requires only 4 or 6 lag screws or bolts to mount. Opening may be round or rectangular—panel will cover all irregularities of cut opening.

**GUARDS AVAILABLE**—Neat appearing, protective guards for inlet side to eliminate hazards are available for all units.

**EASY TO CLEAN**—Streamlined surfaces allow cleaning in minimum time. Finished in gray Hammerloid baked enamel.

**RATINGS**—According to National Association of Fan Manufacturers and American Society of Heating & Ventilating Engineers.

**GUARANTEE**—Peerless Electric Fans and Motors are guaranteed against defective workmanship or material for a period of one year from date of shipment from factory. Each unit, when shipped, is registered and the serial number identifies it immediately for spare parts or duplicates.

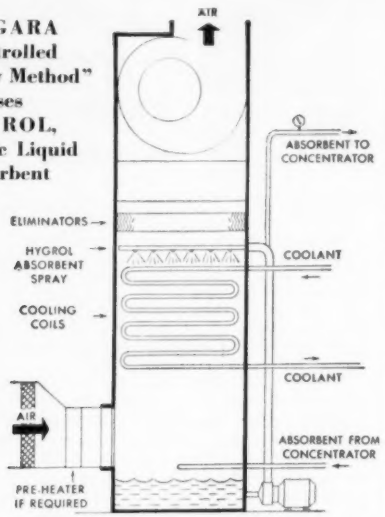



| Model | Fan Diameter | Capacity C.F.M. | Motor H.P. | R.P.M. High | Recommended Shutter Size | FAN PERFORMANCE AND DIMENSIONS A | B | C | D | E | F | Shipping Wgt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PVS-16 | 16" | 2150 | ⅛ | 1100 | 16" | 24 | 22⅛ | 8½ | 16½ | 1¼ | 2¼ | 55 |
| PVS-18 | 18" | 2900 | ⅛ | 1100 | 18" | 26 | 24⅛ | 12 | 16½ | 1¼ | 3 | 75 |
| PVS-24 | 24" | 4550 | ¼ | 820 | 24" | 34 | 31¾ | 12⅝ | 24¾ | 1¼ | 3½ | 90 |
| PVS-30 | 30" | 7375 | ½ | 660 | 30" | 40 | 37¾ | 13¾ | 30 13/16 | 1¼ | 3 11/16 | 145 |

THE Peerless Electric COMPANY
WARREN, OHIO

# New Method Gives Precise Control in Air Conditioning

**NIAGARA "Controlled Humidity Method" Uses HYGROL, Hygienic Liquid Absorbent**



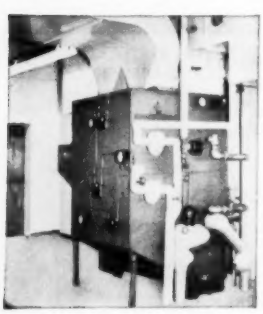

NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

● The "Niagara Controlled Humidity Method" gives complete control of temperature and relative humidity, holding constant conditions or varying them at the will of the user. Especially, it provides dry air at normal atmospheric temperatures with little or no refrigeration required.

The air is filtered and then enters a chamber where it is dehumidified in passing thru a spray of "Hygrol" Liquid (a hygienic hygroscopic chemical that absorbs the air-borne moisture and contains no salts or solids to precipitate). In the same chamber are located cooling coils which remove the latent heat of evaporation and also sensible heat as required.

The absorbent liquid spray falls into a tank at the base, where it is piped to a concentrator, removing moisture taken from the air. The re-concentrated liquid returns to the system. This process is continuous, and the apparatus operates at full capacity at all times.

This equipment is manufactured in a range of sizes providing from 1000 to 20,000 CFM of conditioned air from a single unit.



Installations have been made in food and chemical process industries, in packaging hygroscopic products, for preventing condensation of moisture on metals and other products in storage, in air conditioning for laboratory control and for human comfort.

•

For further information, write Niagara Blower Co., Dept. HP, 405 Lexington Ave., New York 17, N. Y.

# MEETINGS & CONVENTIONS

**Indoor Comfort Conferences,** sponsored by the National Warm Air Heating and Air Conditioning Association, 145 Public Square, Cleveland, and conducted under the direction of Guy A. Voorhees, technical secretary—Covering the design and installation of warm air heating systems, the conferences will include nonresidential installations, such as in churches, garages, stores, etc. Conferences scheduled for this month are: Atlanta, Ga., the 10th and 11th; Chicago, the 17th and 18th; South Bend, Ind., the 20th through the 22nd; Fort Wayne, Ind., the 24th and 25th; Detroit, the 28th and 29th. The tuition fee is $12.50, except for the three day South Bend School which is $15.00.

**American Society of Mechanical Engineers,** 29 W. 39th St., New York City—Spring meeting, April 12 to 14, Hotel Statler, Washington, D. C.

Among the many technical papers scheduled for presentation are:

Fly Ash Collection for Small Plants, by A. A. Peterson, Prat-Daniel Corp.
Fly Ash Collection Equipment for Small Boiler Installations, by W. L. Prout, Green Fuel Economizer Co.
Factors Influencing Dust Collection for Small Boilers, by H. O. Danz, American Blower Corp.
Optimum Tube Size for Shell and Tube Type Heat Exchangers, by F. D. Cardwell, Chemical Construction Corp.
Loss Coefficients for Abrupt Changes in Flow Cross Section with Low Reynolds Number Flow in Single and Multiple Tube Systems, by W. M. Kays, Stanford University
Local Coefficients of Heat Transfer for Straight Fins, by M. L. Ghai and M. Jakob, Illinois Institute of Technology
Experimental Evaluation of Human Shape Factors with Respect to Floor Areas, by F. W. Hutchinson, University of California
Sealing of High-Pressure Steam Safety Valves, by R. E. Adams, Battelle Memorial Institute and J. L. Corcoran, Manning, Maxwell and Moore, Inc.
Practical Application of the Anthratube, by R. C. Johnson, Anthracite Institute
Properties of Thin-Walled Curved Tubes of Short Bend Radius, by T. E. Pardue and I. Vigness, Naval Research Laboratory
Thermal Shock and Other Comparison Tests of Austenitic and Ferritic Steels for Main Steam Piping, by W. C. Stewart, U. S. Naval Engineering Experiment Station

The Semi-Annual meeting will be held June 19 to 23, Hotel Statler, St. Louis. Fall meeting, September 19 to 21, Hotel Sheraton, Worcester, Mass. Annual meeting, November 26 to December 1, Hotel Statler, New York City.

**Ohio State University Welding Engineering Conference,** Columbus, Ohio, April 14 and 15—Economy in design and production is the theme of technical papers scheduled. Among the papers, one on welding stainless steels is to be presented by G. C. Kiefer, associate director of research, Allegheny Ludlum Steel Corp. Reservations for the affair can be made through the department of welding engineering.

**New Jersey Society of Professional Engineers,** 86 E. State St., Trenton 8, N. J.—The 26th annual convention and an industrial, engineering, and commercial exhibit, April 14 and 15, Essex House, 1050 Broad St., Newark, N. J.

**Western International Association of the Refrigeration Service Engineers Society**—Educational conference, April 21 to 23, New Washington hotel, Seattle. For additional information, write W. S. Merriam, 3757 W. Thistle, Seattle 6.

# It's EASY to install "Payroll Savings"

If you've put off installing the Payroll Savings Plan in your company because you feel it would be "a lot of work," then this advertisement is certainly for you! Because it's really very *simple* to give your employees the advantages of investing in U. S. Savings Bonds the easy, automatic "Payroll" way.

## . . . and 20,000 companies' experience proves it pays!

## HERE'S ALL YOU NEED TO DO

***Appoint one of your top executives as Savings Bond Officer. Tell him to get in touch with your State Director, Savings Bonds Division, U. S. Treasury Department. Here's what happens . . .***

The State Director will provide application cards for your employees to sign—plus as much promotional material and personal help as necessary to get the Plan rolling in your company.

Those employees who want Savings Bonds indicate on the applications: how much to save from their pay; what denomination of Bonds they want; and the inscription information to appear on the Bonds.

Your payroll department arranges to withhold the specified amounts, arranges to get the Bonds, and delivers them to the employees with their pay.

The Bonds may be obtained from almost any local bank or from the Federal Reserve Bank or may be issued by the company itself upon proper certification by the Federal Reserve Bank or Branch in the company's District.

## THAT'S ALL THERE IS TO IT!

In case you're skeptical as to how many of your employees would like to have Payroll Savings, canvass your plant—and be prepared for a surprise. (Remember that pay-check withholdings for Bonds are *not* a "deduction"—the employee takes home his Bonds with his pay.) One leading manufacturer, who had professed little faith in the Plan, found his eyes opened when he asked the people in his plant whether they would like to obtain Bonds in this way. Within only six months after he installed the Plan, half his employees signed up. A prominent aircraft manufacturer, whose company had used the Plan for some time, was not aware of its potentialities until his personal sponsorship increased participation by 500% among his company's employees.

### THE BENEFITS ARE BIG— FOR EVERYONE

The individual employees gain security—they know that the Bonds they hold will return $4 for every $3 at maturity. The company gains from the resultant increased stability and efficiency of its workers. The whole nation gains because Bond sales help stabilize our economy by spreading the national debt and by creating a huge backlog of purchasing power to boost business in the years ahead.

Is it *good policy* to deprive your company of Payroll Savings—even one more pay day? Better at least have a talk with your U. S. Savings Bonds State Director, get the answers to your questions, and *know for sure.*

The Treasury Department acknowledges with appreciation the publication of this message by

**Heating Piping & Air Conditioning**

This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and The Advertising Council.

**American Society of Mechanical Engineers,** 29 W. 39th St., New York 18—The 1950 process industries division and Pittsburgh mechanical engineering conference, April 24 to 27, Hotel William Penn, Pittsburgh, jointly sponsored by the ASME process industries division and the Pittsburgh section. Among the many papers scheduled is one on dehumidification of air for blast furnaces, by John Everetts, Jr., of the office of Charles S. Leopold. A symposium on dust collection and control will also be held.

**National Oil Heat Exposition,** sponsored by the Oil-Heat Institute of America, Inc., 6 E. 39th St., New York 16.—The affair will be held in conjunction with the 27th annual meeting of OHI, April 24 to 28. The exposition will be held in Commercial Museum, Philadelphia. Convention sessions and business meetings will be held at the Benjamin Franklin hotel.

**American Gas Association,** 420 Lexington Ave., New York City—The 1950 Research and Utilization Conference of the association will be held April 25 and 26 at the Hotel Statler, Cleveland. Gas appliance venting, ignition, and combustion will be covered in the various sessions.

**Heating, Piping, and Air Conditioning Contractors National Association,** 1250 Avenue of the Americas, New York 20—1950 annual meeting, May 8 to 11, St. Francis hotel, San Francisco. Arrangements have been made with United States Travel Agency, Inc., 807 15th St., N.W., Washington, D. C., for a special sightseeing tour in connection with the convention.

Daniel Hayes, Room 200, 61 Grove St., San Francisco, is handling hotel reservation requests.

**Midwestern Conference on Fluid Dynamics,** to be held May 12 and 13 at the University of Illinois, department of mechanical engineering, Urbana, Ill.—The conference will be held in conjunction with the dedication of the new mechanical engineering building and a meeting of the fluid dynamics division of the American Physical Society.

Some of the technical papers scheduled are:

The Problem of the Flow Through Turbo-Machines, by W. Spannhake, senior research scientist, Armour Research Foundation

Analysis of Some Thermodynamic Processes with the Method of Characteristics for Nonsteady One-Dimensional Flow, by H. H. Korst, associate professor, University of Illinois

Action of Friction in Nonsteady Flow of Fluid, by N. A. Hall, professor, University of Minnesota

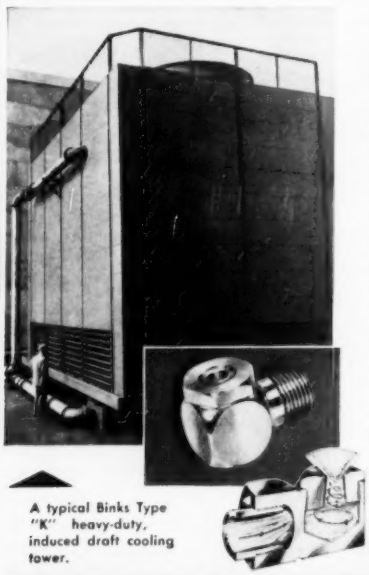
Compressible Flow Through Sharp Edged Orifices, by R. G. Cunningham, research assistant, Northwestern University

Velocity Profiles in Annuli, by J. G. Knudsen, professor, University of Oregon, and D. L. Katz, professor, University of Michigan

Impact Tube Measurements in Isothermal Air Jets, by J. F. Taylor, research assistant, University of Illinois, and E. W. Comings, professor, University of Illinois

Behavior of Oil-Water Mixtures in Separators, by A. C. Ingersoll, project assistant, hydraulic and sanitary laboratory, University of Wisconsin

**Smoke Prevention Association of America,** 1950 annual conference, May 21 to 25, Mount Royal hotel, Montreal, Canada—A number of technical societies will sponsor the various sessions. Some of the technical papers scheduled are:

A typical Binks Type "K" heavy-duty, induced draft cooling tower.

Clog-proof Rotojet nozzles are used in both the spray-filled and deck-filled towers.

## For large scale water cooling . . .

## Binks Type "K" Towers cut your costs

**Eliminate costly water consumption**

Let a Binks Type "K" heavy-duty, induced draft tower cut your cooling-water costs by reducing water consumption to the minimum. The same cooling water is circulated over and over. A small power charge for pumping takes the place of a big water bill.

**Assure better performance**

Type "K" cooling towers give high cooling efficiency...the correct air to water ratio. They create their own breezes...are independent of natural air circulation. This is a big advantage in crowded locations. Binks Rotojet Nozzles insure correct fluid breakup for maximum heat dispersal.

Binks Type "K" towers are used extensively in connection with large-scale air conditioning, refrigeration, and related applications. They are made in a range of standard sizes in both deck-filled and spray-filled models. A Binks engineer will gladly help you solve cooling problems.

*Send today* for technical bulletins describing Binks Type "K" Induced Draft Cooling Towers. Ask for:

**Bulletin 36**—Type 2KS Spray Filled Cooling Towers (150 to 645 GPM)

**Bulletin 37**—Type 2K-W Wood Filled Cooling Towers (150 to 495 GPM)

**Bulletin 39**—Heavy-duty Type "K" Cooling Towers (1000 to 3000 GPM)

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**197 Pages — 8½" x 11" — $1.50**

This practical book is made up of outstanding papers and data on industrial piping selected from past issues of "Heating, Piping & Air Conditioning." It is a most comprehensive collection of case studies, showing how various difficult piping problems encountered in different industrial plants were successfully worked out by piping experts.

Design, installation, operation, and maintenance . . . steam, air, gas, oil, process, water and refrigeration piping . . . piping in pulp and paper and steel mills, in automobile plants and breweries, in the food and chemical and textile industries, and in many other types of manufacturing plants are dealt with from many different angles.

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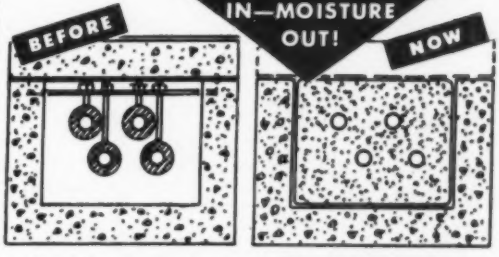
**NOW! Easy, Low-Cost**

# REINSULATION

**For Underground Heating Pipes**

**CAST-IN-PLACE "Z"crete***
**HELPS KEEP HEAT IN—MOISTURE OUT!**




Open void permits water to attack insulation and increases the chance of heat loss due to convection.

No more voids where water can collect . . . "Z"-Crete solid construction reduces chance of convection losses.

**Permanent as the Earth Itself**

Here's a case history from a housing project in Norfolk, Virginia! Six years after the original, old-fashioned installation, a loss of efficiency was seriously hampering the hot water supply to the housing units. When opened up, the insulation was found to have deteriorated extensively, even disintegrated in spots. Corrosion had attacked metal parts and piping.

Reclaimed with a solid pour of Z-Crete insulation, this system is now a permanent, highly-efficient heating conduit.

Perfect for reinsulation—ideal for new work—Z-Crete is the modern, fast, low-cost way to keep heat in permanently. There's a licensed Z-Crete applicator near you. Write us for free design data and complete information.

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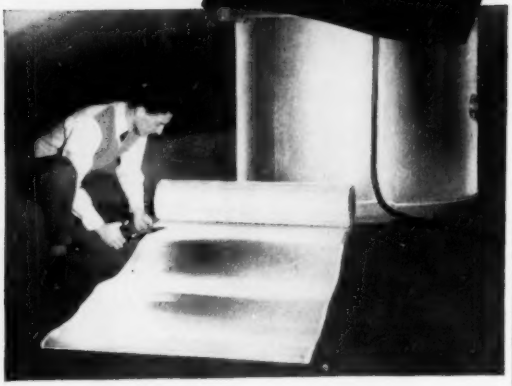
Alfol ASBESTOS INSULATION



REFLECTS 95% OF ALL RADIANT HEAT

IT'S *Efficient* ✓

Alfol Asbestos, a combination of pure Aluminum Foil and ¼" corrugated asbestos, will do the work of 1¾" air cell board.

IT'S *Light* ✓

Alfol Asbestos is reflective insulation and does not rely on bulk to work effectively. Its weight is one-fourth that of ordinary bulk insulations.

IT'S *Inexpensive* ✓

Alfol Asbestos, at one-half the cost of conventional materials, offers you 88% greater efficiency with 75% less bulk, one-fourth the weight and at one-half the cost.

IT'S *Convenient* ✓

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Health Implications of Air Pollution Control, by J. J. Bloomfield, assistant chief, U. S. Public Health Service

The Properties of Air Pollutants, by Dr. H. H. Schrenk, research director, Industrial Hygiene Foundation (Division of Mellon Institute)

Unsolved Problems in Air Pollution Control, by H. B. Lammers, chairman, Coal Producers Committee for Smoke Abatement

Other papers will deal with the operating engineers' reactions to smoke ordinances and public relations in air pollution control.

Reservations for hotel accommodations should be sent to R. Grossman, secretary-treasurer, convention committee, Room 203, 1405 Bishop St., Montreal, Canada.

**National District Heating Association,** 827 N. Euclid Ave., Pittsburgh 6—The 41st annual meeting, Grove Park Inn, Asheville, N. C., May 23 to 26.

The Hotel Statler, Detroit, has been selected for the Society's 1951 annual meeting.

**Midwest Refrigeration and Air Conditioning Educational Exhibit and Conference,** May 25 to 28, Hotel Jefferson, St. Louis.—This is the first in a series of four sectional conferences sponsored jointly by the Refrigeration Equipment Manufacturers Association and the Refrigeration Service Engineers Society. The second in the series will be held in the Municipal Auditorium, Long Beach, Calif., November 17 to 19. Additional information may be obtained from the REMA public relations department, 1346 Connecticut Ave., N.W., Washington 6, D. C.

**Canadian International Trade Fair**—To be held May 29 to June 9, Exhibition Grounds, Toronto, Canada.

**Stoker Manufacturers Association,** 307 N. Michigan Ave., Chicago 1—The 1950 annual meeting, to be held in Chicago, early in June.

**American Society of Refrigerating Engineers,** 40 W. 40th St., New York 18—The 37th spring meeting, June 4 to 7, Muehlebach hotel, Kansas City, Mo. Nine papers, grouped into one session of technical papers and two sessions of application type papers are scheduled.

**Industrial Hygiene and Human Relations**—A training course designed especially for the benefit of safety personnel to be held June 19 to 21, University of Michigan School of Public Health, Ann Arbor, Mich. Subjects to be discussed include industrial heating and ventilating and industrial health problems relative to solvents, degreasing, dry chemicals, plating, pickling, spraying, sand blasting, etc. Applications for enrollment should be submitted to H. E. Miller at the School of Public Health. The fee is $5.00.

**American Society of Heating and Ventilating Engineers,** 51 Madison Ave., New York 10. Semi-annual meeting, Royal Muskoka hotel, on the Muskoka lakes, Ontario, Canada, June 19 to 21. The 1951 annual meeting will be held in Philadelphia, January 22 to 25.

**American Society for Testing Materials,** 1916 Race St., Philadelphia 3—The 1950 annual meeting and 9th Exhibit of Testing Apparatus and Equipment, June 26 to 30, Atlantic City. The 1951 annual meeting is scheduled for

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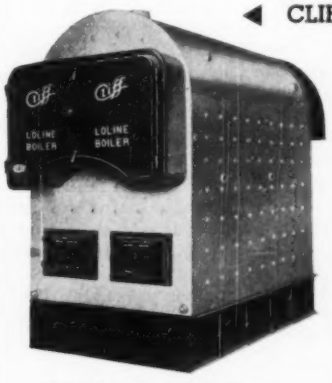


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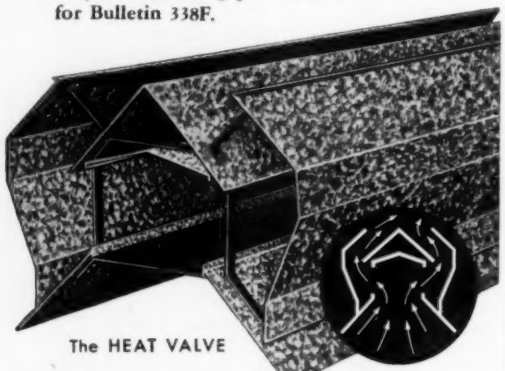

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June 18 to 21, Atlantic City, and the 1952 annual meeting will be held June 22 to 27, New York City.

**First United States International Trade Fair**—To be held August 7 to 19, Chicago. Exhibits will be classified under 29 categories, including both industrial and consumer commodities. Fair headquarters is in the Merchandise Mart, Chicago 54.

**Sixth National Chemical Exposition,** sponsored by the Chicago section of the American Chemical Society, 86 E. Randolph St., Chicago 1—To be held September 5 to 9, Chicago Coliseum. The show will be held concurrently with the national meeting of the American Chemical Society.

**Instrument Conference and Exhibit**—Sponsored by the Instrument Society of America, 921 Ridge Ave., Pittsburgh 12, the 1950 Instrument Conference and Exhibit will be held in the War Memorial Auditorium, Buffalo, N. Y., from September 18 to 22. This will be the fifth national conference and exhibit of the Society.

**American Gas Association,** 420 Lexington Ave., New York 17—The 1950 annual convention will be held October 2 to 6, Atlantic City. The 1951 annual meeting will be held in St. Louis, October 15 to 18.

**Refrigeration Service Engineers Society,** 433 N. Waller Ave., Chicago—The 13th annual meeting, November 17 through 19, Long Beach, Calif.

**Tenth International Heating, Ventilating, and Air Conditioning Exposition,** January 22 to 26, Commercial Museum, Philadelphia—Under the auspices of the American Society of Heating and Ventilating Engineers and managed by International Exposition Co., Grand Central Palace, New York City.

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### Fluid Flow Reduces Bending Vibrations in Pipe

Free vibrations and forced motions due to crosswinds may create important problems in the design of pipe lines supported above ground. An analytic investigation, based on simple beam theory, shows that the flow of fluid in such a pipe line produces marked damping tendencies and thus may reduce the severity of loading encountered. This conclusion is expressed by Holt Ashley, assistant professor, and George Haviland, research assistant, department of aeronautical engineering, Massachusetts Institute of Technology, in a paper, Bending Vibrations of a Pipe Line Containing Flowing Fluid.

In the paper, which was presented at the recent annual meeting of the American Society of Mechanical Engineers, the time dependence of the fundamental mode of a simply supported pipe line is calculated for a number of mass-flow rates, the damping being observed to increase rapidly and the frequency to remain constant over the practically important range. A method is outlined for studying forced vibration, higher modes, and other end conditions. Finally, the problem is discussed in terms of traveling waves on an "infinite" unsupported pipe line.

Copies of the paper, identified as 49—A-22, are available from ASME headquarters, 29 W. 39th St., New York City.

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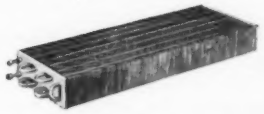

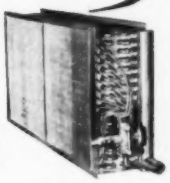

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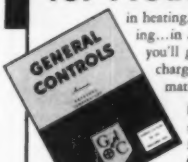


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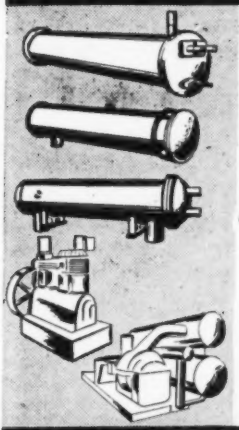

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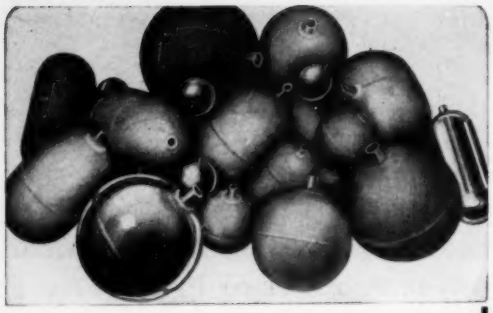

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# RECENT TRADE LITERATURE

*For your convenience in obtaining copies of these bulletins, see coupon on page 163. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.*

**HPAC 7602—AIR COOLED CONDENSER**—The "Unicon" is a self-contained, remote type air cooled condenser consisting of a coil, housing, motor, and fan. The capacity range is from ¾ to 5½ tons. Bulletin U-177 of Kramer Trenton Co., Trenton, N. J., describes the unit.

**HPAC 7603—AIR DIFFUSER SELECTION**—A new 68 page selection manual on its line of air diffusers has been prepared by Anemostat Corp. of America, 10 E. 39th St., New York City. Starting with typical cases the manual tells how to calculate the required air volume, and then explains the recommended technique of locating diffusers and determining the number required. A selection chart shows photos and characteristics of 13 different types of diffusers, and application data and information on rate of air changes per hour is given. Some 30 pages of the booklet give detailed information on capacities, dimensions, neck velocities, radii of diffusion, and static pressures. Accessories, volume control, specifications, and installation information are contained in 18 pages. The last 10 pages deal with the "Anemotherm" air meter, special diffuser applications, typical installations, prices, and weights. Requests for copies of the manual should be addressed to the manufacturer on your company letterhead.

**HPAC 7604—BEARING LOCKNUTS, WASHERS**—Link-Belt Co., 307 N. Michigan Ave., Chicago 1, is manufacturing a line of bearing-positioning locknuts and lockwashers. These are specially designed for locking the various makes of ball and roller bearings in correct position on shafts of 5/16 to 7-11/16 in. diameter. Detailed dimensions are contained in a four page folder (No. 2348).

**HPAC 7605—CHEMICAL FEEDERS**—Black, Sivalls & Bryson, Inc., 720 Delaware, Kansas City, Mo., has recently issued part 2, section 8 of its Catalog 54 dealing with automatic chemical feeders. Operation of the feeders (designed to use air or gas at 25 to 1000 psi) is described and sizes, specifications, and operating data are given.

**HPAC 7606—CONDENSERS**—Bulletin 441-C of Condenser Service and Engineering Co., Inc., 95 River St., Hoboken, N. J., covers its line of "Conseco" condensers. Features stressed in the booklet are design, construction, water flow, deaerating hotwells, and service and maintenance. Auxiliaries such as air ejectors and pumps, together with specialties for facilitating cleaning and maintenance are also covered.

**HPAC 7607—CORROSION RESISTANT TANK LININGS**—Corrosion resistant linings for wood and steel tanks are described in Bulletins C-6A and C-7 of Carbo-

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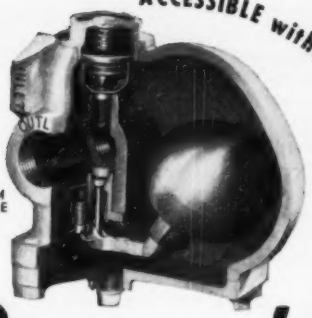

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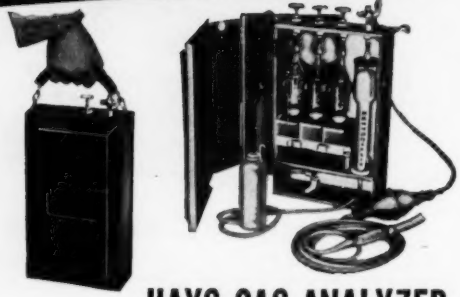

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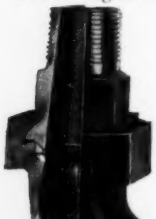

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**HPAC 7608—DUST COLLECTORS**—Methods of using "Dustube" collectors to improve working conditions and quality control on numerous operations such as grinding, blast cleaning, saw glazing, etc., are featured in Bulletin 262 of American Wheelabrator and Equipment Corp., 796 S. Byrkit St., Mishawaka, Ind.

**HPAC 7609—ENGINE COOLERS**—Design and construction features, materials of construction, and dimensions are contained in a new booklet on the lubricating oil and jacket water coolers of Condenser Service and Engineering Co., Inc., Seaboard Trust Bldg., Hoboken, N. J. The extensive engineering section provides information for sizing equipment, including fouling factors.

**HPAC 7610—HEAT EXCHANGER TUBES**—Babcock & Wilcox Tube Co., Beaver Falls, Pa., has prepared a new illustrated bulletin (TB-329) on its heat exchanger and condenser tubes. It describes economical choice of tubing for specific service conditions in heat transfer units and for easy fabrication in heat exchanger apparatus. Factors discussed include resistance to corrosion and oxidation, strength at both high and low temperatures, and problems of bending, expanding and beading.

**HPAC 7611—HEAT EXCHANGERS**—Catalog No. 202 of Patterson-Kelley Co., Inc., 15 Wilson Ave., East Stroudsburg, Pa., is a 36 page booklet containing detailed information on the company's instantaneous water heaters and heat exchangers. General information and tabulated data for selecting equipment are featured. Dimensions are tabulated as are capacities for various steam pressures and water temperature ranges. Data are also given on water pressure loss through the heaters, and condensate coolers, gravity flow heaters, and booster heaters are covered.

**HPAC 7612—INDUCTION HEATERS**—Electric-Arc, Inc., 152-162 Jelliff Ave., Newark 8, N. J., has released a catalog sheet on its induction heaters and control instruments for preheating before welding and stress relieving after welding. Each unit is illustrated and described.

**HPAC 7613—INSTRUMENT, CONTROL PANELS**—An eight page booklet (Bulletin 773) explains how instrument and control panels are made and where they are used. All operations of fabrication are discussed and illustrated. Particular features such as electric clocks, pressure gages, name plates, push-button stations, and signal lights are explained. The manufacturer is Hays Corp., Michigan City, Ind.

**HPAC 7614—INSULATING MATERIALS**—An eight page catalog (No. 2350) on asbestos and other insulating materials used in heating, ventilating, and air conditioning has been issued by Grant Wilson, Inc., 141 W. Jackson Blvd., Chicago 4. Materials described and illustrated include air cell corrugated paper, air cell asbestos, wool

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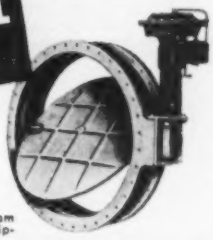

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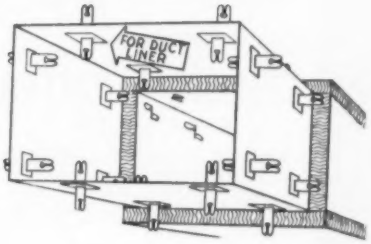


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felt, 85 percent magnesia, hair felt, anti-sweat pipe covering, asbestos protected "Dux-Sulation," expanded mica, etc.

**HPAC 7615—LIQUID COOLERS**—A new catalog sheet of Heat-X-Changer Co., Inc., 415 Lexington Ave., New York 17, gives capacities, dimensions, and other pertinent data on liquid coolers for heavy applications. Units are recommended for use in bakeries, bottling plants, processing applications, etc. Capacities are up to 320 gph.

**HPAC 7616—LIQUID-GAS SEPARATION**—The recently redesigned "Liqui-Jector" of Selas Corp. of America, Philadelphia 34, is recommended for use in precision pneumatic operations requiring positive conditioning of air or gas. Typical applications are said to be in liquid separation, agitation, drying, spraying, instruments, and pneumatic mechanisms. Bulletin SC-10.1 gives detailed information.

**HPAC 7617—LOW TEMPERATURE INSULATION**—Rubatex Div., Great American Industries, Inc., Bedford, Va., has released a 20 page booklet on the use of "Rubatex" R-103-S insulation board for low temperature application. The manual contains detailed application data. The material is an expanded rubber compound made of synthetic stocks. According to the manufacturer, it has a $k$ factor of 0.21 and will not absorb moisture. It consists of individually sealed cells containing nitrogen.

**HPAC 7618—MECHANICAL TUBING**—Bulletin TB-324 of Babcock & Wilcox Tube Co., Beaver Falls, Pa., covers the firm's mechanical tubing. This includes both seamless and welded tubing, hot finished or hot rolled, cold drawn or cold rolled, in carbon, alloy and stainless steel grades—also in various finishes and heat treated.

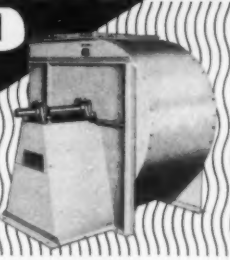
**HPAC 7619—ORNAMENTAL GRILLES**—A new 48 page catalog, issued by Harrington & King Perforating Co., 5655 Fillmore St., Chicago 44, presents a large selection of ornamental grille patterns. The new booklet includes original designs, both classic and modern, and contains dimensional diagrams and tables. Also covered are special grilles, fixed and movable louvers, special panels, enclosures, etc.

**HPAC 7620—PREFORMED SOLDER SHAPES**—Arranged to tell the what, how, and when of the uses of preformed solder shapes, a four page bulletin issued by Solder Specialties, Summit, N. J. contains an illustrated chart showing application in numerous fields. "Pre-Forms" are solder pieces available in various shapes, such as rings, discs, washers, pellets, gaskets, etc.

**HPAC 7621—REDUCING VALVES**—A new selection chart for its line of reducing valves is available from Klipfel Valves, Inc., Div. of Hamilton-Thomas Corp., Hamilton, Ohio. By reference to the service for which the valve is intended, the reduced pressure limits, and other factors, selection of the recommended valve can be made quickly. The chart is used in conjunction with a new bulletin (No. 148) describing and illustrating reducing valves for steam, air, and water. Types covered include lever and weight, air loaded, spring loaded, and pilot control.

# MASSACHUSETTS

## Squirrel Cage and Power Fixed FANS



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**HPAC 7622—SAFETY RELIEF VALVES**—Bulletin 250, issued by Marine and Industrial Products Co., 3731 Filbert St., Philadelphia 4, contains test data and charts, together with capacity tables, for various models of "Mipco" safety valves. Requests for copies of the 12 page bulletin should be addressed to the manufacturer on your company letterhead.

**HPAC 7623—SHUTTERS AND DAMPERS**—Catalog 44 of Air Conditioning Products Co., 2340 W. Lafayette Blvd., Detroit 16, covers "Air-Flo" automatic shutters for wall and ceiling installation, automatic back draft dampers, and manually operated and motor operated shutters. Recent refinements in design, such as the use of corrosion resisting material on moving parts, more effective counterbalance, etc., are featured in the booklet.

**HPAC 7624—SPEED REDUCER**—Bulletin A-470, prepared by Dodge Mfg. Co., Mishawaka, Ind., gives detailed information on the "Torque-Arm" speed reducer. This 16 page brochure contains full-size photos of the entire mechanism and simplified selection tables. According to the company, the only information necessary to select the proper reducer for a given application is the horsepower required and the speed and size of the shaft to be driven. Tables are also included for selecting the size of v belts and sheaves required for the drives.

**HPAC 7625—SPRAYED METAL COATINGS**—The Vol. 4, No. 12 issue of the house organ published by Metallizing Engineering Co., Inc., 38-14 30th St., Long Island City 1, N. Y., reports that sprayed metal coatings give positive protection against corrosion. A number of case histories are briefly presented.

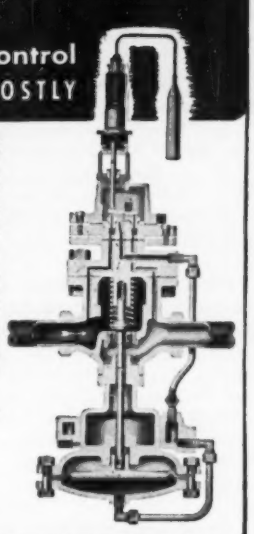
**HPAC 7626—STAINLESS STEEL**—Wallingford Steel Co., Wallingford, Conn., is offering a data sheet and an actual sample of its new 18-8 bright annealed stainless strip. The new steel is finished in all tempers and in widths up to 15 in.

**HPAC 7627—TELEVISION IN INDUSTRY**—The "Utiliscope" is essentially wired television. It is offered by Diamond Power Specialty Corp., Lancaster, Ohio, as a serious tool for making direct observations wherever it would normally be too dangerous, difficult, expensive, inaccessible, tiring, hot, cold, high, low, dark, or small. Bulletin 1025 covers numerous applications, including direct reading of remote instruments, gages, meters, etc.

**HPAC 7628—THREADLESS COUPLING**—Dresser Mfg. Div., Dresser Industries, Inc., Bradford, Pa., has reprinted an article which tells how the company's threadless fittings made possible a 60 to 65 percent reduction in the time required for installing piping on a blast furnace during repairs following a break-out. The author is E. R. Norris, technical advisor, Wheeling Steel Corp.

**HPAC 7629—V BELT MAINTENANCE**—Suggestions to help users determine the condition of their "Texrope" v belt drives are contained in a four page inventory survey check list available from Allis-Chalmers Mfg. Co., Milwaukee 1. The procedure recommended for the survey calls for checking the drive with respect to diameters,

*Accurate*
**Temperature Control**
**NEED NOT BE COSTLY**



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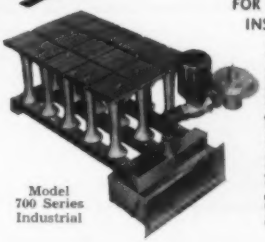

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This equipment pays for itself on the first good job. See your supply house or write Blackhawk for Bulletin 50-B today. Blackhawk Mfg. Co., Department P-4640, Milwaukee 1, Wisconsin.

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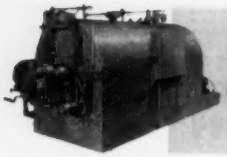

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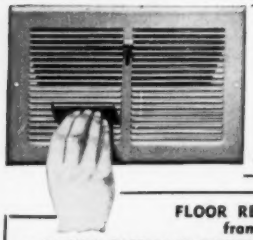

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centers, number and size of belts, belt speed, contact arcs, tension and alignment, together with inspection of belts for scuffing, slip burn, oil deterioration and abrasion, and checking of sheave walls for smoothness and straightness.

**HPAC 7630—WELDING MACHINE**—A new arc welding machine catalog, the first to include all the machines in the "Airco" line, is available from Air Reduction Sales Co., Div. of Air Reduction Co. Inc., 60 E. 42nd St., New York 17. The 36 page catalog, the fourth of a projected series of 10, deals with both a-c and d-c machines and gives operating data, specifications, and other pertinent information.

**HPAC 7631—WELDING RODS AND FLUXES**—Data on several new products are presented in a revised edition of the 32 page, pocket sized catalog offered by All-State Welding Alloys Co., Inc., 273 Ferris Ave., White Plains, N. Y. Covering low temperature welding and brazing rods and fluxes, the booklet describes a new general purpose steel electrode, a high alloy steel electrode, a phosphor bronze electrode, a silver bearing copper alloy for gas welding, and a new line of brazing alloys.

**HPAC 7632—WELDED STAINLESS STEEL**—A four page brochure on arc welding stainless steel with "Stain-Trodes" is available from Eutectic Welding Alloys Corp., 40 Worth St., New York 13. The folder (Form EU-19) contains a number of case histories.

**HPAC 7633—WETTING AGENT**—"Aquadyne" is said to be an active and highly concentrated multiphase wetting compound furmulated to reduce the interfacial tension of ordinary water and to increase the wettability of all types of dust and powdery materials. The manufacturer, Aquadyne Corp., 220 E. 42nd St., New York 17, also offers a "Hydroblender" for dissolving the material in proportion to the amount of water passing through a venturi nozzle. A new four page folder covers advantages and recommended procedures for the control of coal and ash dust.

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### Welding Handbook Brought Up-To-Date

The third edition of Welding Handbook has been published by the American Welding Society and is a complete, authoritative, and up-to-date volume.

The 1650 page book contains 65 chapters covering more than 30 welding and cutting processes. Also included are chapters on cost estimating, welding metallurgy, physics of welding, a dictionary of welding terms, filler metal specifications, inspection, welding symbols, etc. A bibliography is included at the end of each chapter listing important codes standards, books, and technical articles.

The chapter on industrial piping leads off with a discussion of governing codes and specifications and successively covers qualification of welding procedure and welder; weldability, recommended service conditions, and allowable working stresses and pressures for various materials; types of welds; workmanship; and inspection and testing.

Copies of the handbook may be obtained from AWS headquarters, 33 W. 39th St., New York 18 for $12.00.

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SALES ENGINEERS, with experience in the sale of mechanical equipment for commercial and industrial buildings, wanted for positions as sales engineers for heating, ventilating, and air handling apparatus. Positions are available at various locations. Personal interviews will be granted only after receipt of written application giving full details of experience. Address: Sturtevant Division, Westinghouse Electric Corp., Dept. AH, Hyde Park 36, Boston, Mass.

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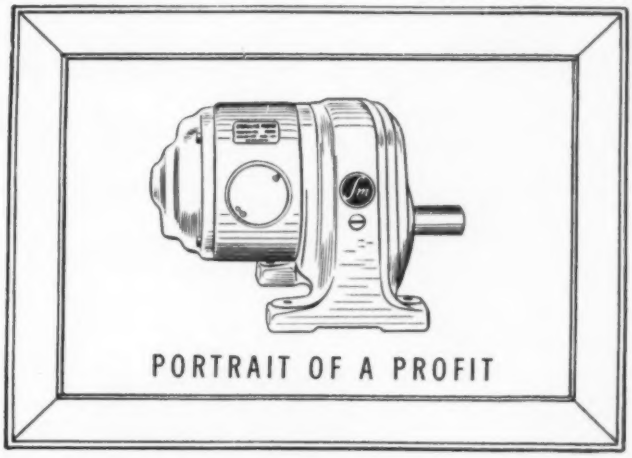


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These fans are furnished with wheels of the non-overloading design, making possible the use of smaller motors for drive and thereby reducing initial cost.

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These fans have multiblade wheels with blades tipped forward in the direction of rotation. Extreme quietness of operation is the result.

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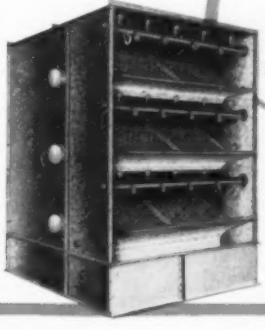

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**McDONNELL No. 47-2** Boiler Water Feeder—Low Water Fuel cut-off combination for the automatically fired boiler up to 5,000 sq. ft. capacity; maximum steam pressure, 25 lbs. Also available without switch for hand fired boilers.

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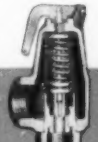

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# McDONNELL *Boiler Water Level Controls*